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THE
MORPHOLOGY OF THE HUMAN BODY

CLINICAL COMMENTARIES

DEDUCED FROM

THE MORPHOLOGY

OF

THE HUMAN BODY

BY

~~PROFESSOR~~ (ACHILLE) DE-GIOVANNI

DIRECTOR OF THE GENERAL MEDICAL CLINIC, UNIVERSITY OF PADUA

TRANSLATED FROM THE SECOND ITALIAN EDITION

BY

JOHN JOSEPH EYRE

M.R.C.P., L.R.C.S.I., D.P.H. CAMBRIDGE

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DEDICATION OF THE FIRST EDITION

TO CHARCOT

Illustrious Master and Friend,—

To the genial conversations which we had during the not a few days we passed together in cultured and prosperous Milan I owe two very precious things—that is, your friendship and the encouragement to continue in the studies which for a considerable time I had taken up, and whose nature I had much pleasure in discussing with you.

You, who to the celebrity of your name unite rare kindness of heart, will comprehend the pleasure of this record, and will permit me to remind you that one day, after having spoken of the method of clinical studies, you expressed some ideas completely in agreement with those which animated my work; and, happy in having found in you a wise interpreter, I requested, and you consented, that this book should be adorned with your illustrious name.

To you, therefore, I dedicate these pages, in which, worthy of you, you will find at least the principles of the science which, if I do not err, must be the fountain of progress; because, introduced into the clinical field, they will serve to discover the natural reason of many facts which up till now have been simply classified by empiricism and differently interpreted by unstable theories.

The oldest of medical doctrines—namely, that which aims at the knowledge of the human organism as a whole—overcome by innumerable and prodigious analyses, remains mute, forgotten, and in its body bears the effects of the scholastic polemics that wished to strike it to the heart, while they ought to have studied to despoil it of its defects alone, the fruit of time.

But the philosophic spirit which radiates from the history of the evolution of living things enters our horizon, and enables us to perceive anew the lost conception of the unity of the organism. *It presents itself under* *another aspect, and reveals to us the mechanism by which, from the association of its component parts, the* unity *and the* variation *of the* being *and the modes of its* transformations *in time arise.*

The old body of medical doctrine *renewed lends itself to the demonstration of the* individuality *in its concrete morphological value, and, evoking from history the philosophico-mathematical principle of the Italian school which was called after Pythagoras, becomes science, acquires the instinct of exactness, and proceeds with the escort of numbers and measurements.*

Wherefore for upwards of sixteen years I endeavoured to find by means of measurement of the parts of the body the scientific formula *that could guide the pathologist to the knowledge of the* individuality *with its physiological and pathological expressions, it being necessary to reveal the root of the morbid fact in the state of the organism and in its transformations through the different ages, urging it to explain the variations of the clinical forms by the variations of the* morphological combinations.

The very grave theme bound me to studies which embraced the scale of beings from Man to the kingdom of the Protista. I confronted the most arduous questions of the day, concerning which I formed opinions not always conformable to those of the majority. By virtue of this my work seemed audacious; but clinical observations, on the one hand, and the friendly and learned observations of Maggi, the very able worker in comparative anatomy, on the other, incited me to undertake this modest essay, which in your kind reception, illustrious master, has its best reward.

With respectful and sincere friendship,

A. DE-GIOVANNI.

PADUA.

PREFACE TO THE SECOND EDITION

In this edition I have retained the dedication which I made of the first to the illustrious Charcot, for two reasons :

First, because the sentiments which induced me to dedicate to him the fruit of my long and fatiguing work have ever since remained active in me, and because the encouragement which I subsequently received from him also in academic form has almost imposed upon me the duty of honouring his memory.

Secondly, because the general conceptions which I expounded in the dedication transport us, I think, into that historical and philosophical atmosphere from which I started, and in which resound the pure and perfectly harmonious notes of classic empiricism and naturalism from which the scientific thoughts of modern medicine were gradually composed. Hippocrates, Malpighi, and Virchow indicate the most luminous epochs of the history of medical thought. Hippocrates, from the philosophy of Pythagoras, that can be called the germ of the positive philosophy of our day, drew the principle of harmony, of universal conspiration, of the equilibrium of the organic forces, to enable him to observe and reason about the facts of human Physio-pathology, and which forms the first code of our science. To this code Malpighi, by intuition of genius, was attracted, though against the tendency of his time, as he tells us himself. Malpighi, of whom Haeckel says that few biologists can equal him in his profound capacity for research, and in his wide philosophical comprehension—Malpighi interprets the Hippocratic mind, and from the contemplation of the organic actions sought in the Three Anatomies (vegetable, animal, and human) soars to the luminous visions of pathology, and dictates the following sentence, which adumbrates the theory of evolution : "*The things of Nature, though they seem very unlike, still, when considered with exactness* *and maturity, are found to be not so disunited that one cannot observe a concatenation and uniformity of working, and therefore they reciprocally illustrate one another.* Virchow, a splendid emanation of the times thus prepared, has the clearest vision of the origins of a great part of pathology and of the evolution of organic forces, when he affirms that the abnormal development of the organs is the object of necessary investigations for solving the difficult questions regarding *morbid dispositions*, and when he says that every ethnological form finds its equivalent in general pathology.

In reality, the modern morphological method is founded exclusively upon experience concerning the facts of the organization of Beings, and is directed by the doctrinaire conceptions which from them are legitimately derived.

Morphology has also suggested the *quantitative* study of Beings, and relatively to Man, with whom we must occupy ourselves, I maintain that *Morphology has united to itself somatometry for the positive verification of the Individuality according to physiological and pathological requirements.*

Thirteen years have elapsed since, following this scientific method, the first edition of this book was published. To-day it is satisfactory to me to know that similar conceptions have not only been confirmed, but also fully approved by able Italian biologists, such as Camerano, Andres, Ficalbi, Grassi, and others.

And I am equally pleased that these thirteen years have been as many years of control to the somatometrical method introduced by me for the *verification of the human individuality*, though the work especially of my pupils and of others.[1]

Therefore I think that every clinical investigation should be conducted on the basis of the individuality morphologically verified, for every other verification of the facts and phenomena in relation to doctrine and practice in their turn in every concrete case individualize themselves, or, to speak better, present themselves, not such as they may be according to the data of general biological experience, but such as they *must* be in the morphological type of the individual under examination.

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[1] I have much pleasure in recording here the names of the able doctors Massalongo, Pennato, Pugliesi, Remor, Romaro, Nalin, Chiaruttini, Messedaglia and Vainanidis, Rothschild, Lohde, Surgeon-Captain Ostino with Lieutenant Gilardoni, Galdi; Viola, who is about to publish a book which will do him credit; and Professor Castellino, of the University of Naples; and Gregoracci—warm supporters of the morphological method.

Medicus minister naturæ. In this expression are contained a precept and a programme: one remembers that the action of the physician must always correspond to the requirements of the nature of the patient, and that he must study the natural laws which govern the organization of individuals in order that he may be able to understand their association and mechanism, as well as the mode of reaching by their means the supreme aims of the science. It is not the histological or chemical or anatomico-pathological particular, but all this in the environment of the Individuality, morphologically understood, which must preoccupy us in our scientific and humanitarian work, because the law of Harmony, of Universal Conspiration, of Equilibrium of Organic Actions, presents in every human individual infinite varieties of actualization.

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THE
MORPHOLOGY OF THE HUMAN BODY

2

INTRODUCTION

Even in the first years of my medical education I recognized that medicine had entered into the fellowship of the natural sciences, and one demonstrated it adducing the very valuable conquests of the microscope, chemistry, physics, and the experimental method.

During these first years I watched enthusiastically the rising of the new sun: the *cellular pathology* was the necessary foundation, the vital environment of medical science.

Dwelling upon the hypotheses derived from the new truths, I became convinced that medicine must be considered as a branch of zoology, or—to use an expression of Topinard—of zoological anthropology, which is the study of the human group considered in its relations with the rest of organized nature (*Éléments d'Anthropologie générale*, p. 185, Paris, 1885). Further, passing from the professional teachings to the field of practice, I became aware that this was not conformable in every respect to the modern naturalistic method.

Although I treasured up every new cognition of anatomy, physiology, and semeiology, at each step I found myself confronted by the same unknown; the most subtle analyses, though they were suitable for enabling me to conceive the concrete idea of morbid states, were not sufficient to enable me to understand precisely diseased man. Very frequently, after having pondered over my work, and having made use of every means known to the science and art, I had to content myself with concentrating my thoughts in words which expressed the unknown much more than the known—in the words *constitution*, *temperament*, *individuality*, *predisposition.*

And my mind after long meditations became more and more convinced that medicine, as part of zoology applied to man, required a method for arriving at the scientific knowledge of the *Individuality*, without which constitution, temperament, predisposition, would always remain vain expressions, very obscure problems.

To us, introduced to the science in the early days of the revival of medicine in Italy, the theories of natural history were not explained. This was nothing but a dry emanation of names and of external characters; when, on the contrary, with the demonstration of the main facts of Nature the fundamental principles of the organization—the biological law—should have been explained to us.

Being ignorant of this, I awaited from the progress of the science the explanation of the problems which daily confronted me. In 1866—that is, four years after I had obtained my degree—there fell into my hands a book whose title, as well as the name of the author, recommended themselves to me. This was food to my curiosity in my leisure hours, and thus I became acquainted with the *Philosophie zoologique* of Lamarck.

The study of this book, though I was incapable of criticizing its particular doctrines, including the fundamental conception in its entirety and importance, produced a revolution in my scientific ideas which equalled that already brought about by Cabanis in the order of psychological ideas.[1]

The *theory of descent* enabled me to understand the transformation of species, the law of adaptation, that of atavism, and the *natural history of creation*—conceptions which were nourished and enlarged by later studies.

And in the meantime I meditated on, and interpreted in every sense, by means of physiological and clinical observations, the passage of Lamarck which says: "*Every individual after birth*

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[1] When reading Lamarck, there recurred to me some facts concerning comparative anatomy which I gathered from that incomparable teacher, the celebrated anatomist Panizza, whose memory, if it be recorded in imperishable scientific monuments for his classical anatomical researches on man and animals, I would wish also to be recorded for the trouble which he took, on every occasion that the subject of his lecture gave him, to demonstrate the facts which are the foundation of the scientific conception of phylogeny. Therefore one can say that he was the able precursor of the reform in the teaching of anatomy expounded to physicians as the basis of the naturalistic culture necessary for them.

finds himself in the midst of special circumstances which contribute to render him what he is in the different epochs of life."

The very obscure problem referred to above—namely, that regarding the study of individuality—acquired in my opinion more and more importance, and medical practice demonstrated to me how urgent its solution was.

While admitting the weak side of the doctrine of constitutions and of temperaments, nevertheless I maintain the justice of the practical views which have led so many able minds to conceive and to reform many times that doctrine.

Whenever and under whatsoever form one meditates on it, one will feel the necessity of trying to study the *individuality*.

I was very soon convinced that the polemics between the new times and the old must be given up ; that as regards these doctrines it was necessary to separate the facts from the words, to discover in the spirit of the positive observations, dimmed by strange scholastic delusions, the clear allusion to the laws of individual organization.

Further, although one knows exactly the histology and physiology of the nerve, muscle, lung, connective tissue, glands, etc., and makes use of such knowledge for describing the organs and functions of every individual, one does not yet know how it is that from the fusion of these elements originate individuals who, when compared with one another, present infinite physiological variations—originate those individualities possessing a particular constitution and temperament.

If the classification of constitutions and of temperaments be based on fictitious scholastic conceptions, the classification is cancelled, every aprioristic or even premature classification is excluded. But in the natural morphological characters one studies those complex individual conditions through which every individual is what he is—*a variety* of the species.

Dominated by such thoughts, I passed my years of clinical study independently of the school and of the teachers, observing and registering everything which tended to prove the practical interest of my thesis, or offered itself to me as an argument favourable to its development.

In 1876, in an article on chronic diseases (*Cenni sulle malattie* *croniche e dei vecchi : Gazz. med. ital. lomb.*, serie vii., tom. iii.), I referred *to those special dispositions oft he organism whose study includes whatever remains to be known regarding constitutions.* And I declared that to reach the knowledge of these we had to grope with the mind loaded with new facts *into the series of problems which concern the history of organizations.*

In 1876 also I published my studies on a part of the nervous system (*Patologia del simpatico*, Milano, Tipografia Fr. Rechiedei), in which I showed that this was one of the morphological elements which co-operate in the manifestation of human constitutions besides their normal and pathological variations.

At p. 49 of the above-mentioned book I say : *The phenomena which each individual presents may offer peculiarities* IN NUMBER, EXTENSION, etc. And this fact, recognized by all physicians in every epoch, depends not upon the conditions inherent in the chemistry of the organism, but upon the *organization and anatomical distribution of the nervous system through which healthy individuals are differentiated from one another, and the factors that give rise to the symptoms vary.*

Further, at p. 195 and following pages I give clinical facts as well as others scattered throughout the work for the purpose of proving the truth of my proposition.

On the basis of my observations and analyses in those pages I proposed the name by which I wished to indicate that special condition of the nervous system owing to which it occurs that individuals feel and react differently to the causes and stimuli which affect them : and I proposed that this special condition should be called *nervous idiosyncrasy*, which I divided into *permanent* and *transitory*. I connected the former with the primary organization, or with irremovable morbid conditions in the centre of innervation; the latter with temporary causes, which may influence directly or indirectly that centre or a part of it. Therefore in every concrete case idiosyncrasy may also be the manifestation of a very circumscribed part of the nervous system.

In 1878, discussing the pathogenesis of gout and of chronic rheumatoid arthritis (*Annal. univers. di med. e di chir.*, vol. ccxliii.), I made new applications of the physiological conception of nervous idiosyncrasy, and explained the pathogenesis of the gouty diathesis, connecting it with the morphological conditions of the individual and with their changes depending on the mode of life.

In February, 1879, in a preliminary communication on the symptoms of pulmonary phthisis (*Rendiconti del R. Istituto lombardo di scienze e lettere*), I made ample application of these principles demonstrated by irrefutable facts, which later on I more fully expounded in another publication (*Pulmonary Phthisis*, Tip. Detken, 1882, Napoli) to show that not only the symptoms of the disease, but also the predisposition to it, were connected with the special morphology of the individual.

In 1879 also, in my introductory lecture to the course of clinical medicine at the University of Padua, I spoke of the *Aspirations in the Method of Clinical Investigation* (see *Bollettino scientifico*, anno I., Pavia), which will reach final perfection when the knowledge of the laws of organization will suitably co-operate in the study of healthy and of diseased man.

And in the following year, describing the results of the investigations which I had carried out for some time, I explained the method of clinical anthropometry directed to collect the anatomical data that, together with the physiological criteria, must lead to the knowledge of the morphological type in the concrete case, and I showed the perfect agreement between many facts of clinical tradition and the results of actual researches. Therefore I maintained—

1. *That the cause of the special morbidity of organisms resides in their special morphology.*

2. *That the same principle which explains the formation of the organs, of the organisms and their function, explains the anomalies of form and of function that the organisms present during the periods of life* (*La morfologia e la clinica : Gazzetta medica ital. della prov. ven.*, No. 50, 1880).

In 1880, in an article entitled *Some Clinical Facts concerning the Pathology of the Heart and the Stomach* (*Giornale internazionale* of Naples), I brought forward facts and considerations which induced Dr. Patella to write a judicious memoir on *A New Element regarding the Pathogenesis of Heart Affections.*

In the same year and successively I published *Notes on Morphological Studies of the Human Body as a Contribution to the Clinic* (*Bollettino scientifico* above mentioned), aiming to prove *if and how the special morphology of organisms constitute the basis of their special morbidity* ; how it happens that *the same diseases present so many nosological varieties* ; *how by means of clinical anthropometry* *one can recognize some fundamental morphological causes which govern the morbidity of the individuals.*

In my clinical lectures I introduced methodically the criteria of anthropometry as a contribution to the study of pathogenesis, and in all my scientific writings I refer more or less clearly to the data of morphology and its applications to clinical medicine. I mention among others those on the alterations of the *ascending vena cava and of its physio-pathology*, that on the *treatment of abdominal scrofulosis* (see De-Giovanni, *Commentari di clinica medica*, Draghi, Padua, 1889).

I hope the courteous reader will pardon this recapitulation. It has a threefold scope :

1. Having to deal with a difficult subject, it was necessary to give the proofs of the long study to indicate the point of departure and the many pathological facts on which I dwelt to obtain arguments useful to my theme.

2. To justify the citations which in the course of this book I am obliged to give of my writings. They having been almost all completed under the inspiration of the general principles of morphology, I shall draw from them facts and judgments which must concur in defining the general principles of its application to the clinic.

3. To insure me the advantage of priority. Very frequently in the farrago of the press some were lost which subsequently had to be re-presented by way of vindication. Then at times, owing to the idea of the author not having been sufficiently developed, the facts were neither accepted nor appreciated. Thus, what is called the right of priority fell into oblivion.

I have also had to claim this right for other works of mine. I cite by way of example that on the *Pathogenesis of Arteritis ;* that on the *Contractile Red Corpuscles*, described by me in 1870 ; and for others briefly mentioned, however slight and controvertible may be their value, I have special tenderness.

Therefore, for the little or no account in which most of my writings have been held up till now I would wish to compensate myself, showing that they are flashes—pale, it is true, but repeated—of the light which the new naturalistic views have shed upon the clinic.

I would wish this all the more because, at the very time in which I desired to expound my studies to workers in clinical pathology, I have seen others bringing forward identical scientific conceptions, and substituting for other disciplines those *aspirations* which for many years I have followed indefatigably in the investigation of diseases.

I allude not to the researches of Virchow (*Ueb. die Chlorose*, etc., Berlin, 1872), nor to those of Tuczek (of which I do not know the original, and which combine with the preceding), but to the accurate, patient, and interesting anatomical researches of Beneke ; to those of Thoma (*Untersuch. üb. d. Grösse u. d. Gewicht d. anatomisch. Bestandtheile d. menschlich. Körpers*, Leipzig, 1882), in which is maintained the same principle which I have introduced—namely, that of the variation of the individual, and the importance derived from it in the scientific study and practice of medicine ;[1] and to those of Schile-Viegand (*Virchow's Arch.*, B. lxxxii., p. 27) and of Hermann v. Hösslin (*Arbeiten aus dem pathologischen zu München, herausgegeben v. Bollinger*, p. 350 *et seq.*, Stuttgart, 1886), although contradictory to the former.

I have said that *the cause of the special morbidity of the organism resides in its special morphology.*

If the reader will reflect on this sentence, and apply it to clinical pathology, he will perceive in the fact of organization the doctrine of constitutions and of temperaments, or, according to Thoma, the theory of *individual differences.*[2]

I consent to follow the path taken by the great masters, and with the facts of the new science I will illustrate the indestructible axioms of physiology and pathology, by which has been transmitted to us, and after us will be transmitted, the best part of their work.

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[1] Thoma proposed to found upon anatomical and other data a theory according to which it would be possible to determine mathematically the *normal* and the *variant* of the individual organization. Although I see the grave difficulties of these studies, and the little utility which at present the clinic can derive from them, still, I must applaud the initiative of my Heidelberg colleague, hoping that meanwhile his studies will enable it to be understood that medicine can assimilate the conceptions of natural history.

[2] Anthropology recognizes the necessity of studying the extent and nature of individual variations before deciding on the variations of races. This study is very difficult, says Topinard, and requires a delicate method, which, however, does not lessen its importance. The growth of the organs and the evolution of forms constitute its fundamental part, and it is also that which highly interests the physiologist and the pathologist.

If we interpret our sentence with the necessary broadness of view, the conception of medicine as a branch of zoology will appear in its true expression, and the factor of heredity, of adaptation, and that of anatomical and physiological correlations which co-operate in the genesis of infirmities, will declare themselves more clearly.

After all, when in presence of a patient we consider the problem of the diagnosis, when we endeavour to discover the reason of his special manifestation, and to trace this back to his intimate morphological condition, we shall feel the necessity of a new means for clinical investigation, of a means which will reveal how the organs and apparatus are mutually associated, how they influence one another, how finally that morphological value, that physiological and pathological variation, constitutes itself in the individual.

No one would wish to maintain that the method of clinical investigation commonly followed is in every way excellent or is truly naturalistic in every respect.

With the increase and improvement in our knowledge our aspirations become greater and more concrete—our intentions must have higher aims.

The application of general conceptions alone to the origin of the morbid processes which are being revealed to us by pathological anatomy and experimental pathology do not fully satisfy the requirements of the clinic, nor are the results of the objective examination and of the anamnesis rigorously instituted sufficient for it.

Even when we have worked wisely searching for and interpreting the history and symptoms, we desire to know another thing—namely, that owing to which the actual case is always new and problematic to us.

Therefore I maintain that the clinical method must be improved by the results of modern morphology.

While not presuming that the results of my modest observations are sufficient to perfect it, I trust that in what I shall expound pathologists will find at least some just views, some facts not destitute of value—an initiative, perhaps, superior to my capacity, but thought out and founded upon undeniable scientific conceptions, for they are corollaries of infallible biological laws.

My timidity, it is hardly necessary to confess, comes from my being alone in the new and difficult contest. However, I am comforted and stimulated by a thought which Lamarck, understanding the difficulty and the novelty of the matter of which he had to treat, wrote in the preface to his book already mentioned. It is as follows : " *Les autorités en fait de connaissances doivent s'apprécier et non se compter ; quoique, a la vérité, cette appréciation soit très difficile.*"

Although my work may be considered imperfect, still, I have the profound conviction that it is placed on a scientific path to which future studies will converge ; and, however humble may be the judgment of it, I shall be contented to have raised questions which stronger and more fortunate minds than mine will solve to the advantage of the science and humanity.

PART I

FUNDAMENTAL MORPHOLOGICAL GENERALITIES

THE point of departure of my studies, as I have said in the introduction, was a fact of very common observation known to all physicians—namely, *that the same disease in different patients may present different clinical appearances.*

In every morbid case it would be necessary to have present, besides the theoretico-practical knowledge of the malady, the knowledge of the circumstance by virtue of which it acquires special form and colour ; the knowledge of those special individual attributes or characters that justify the inadequately interpreted axiom which says not diseases, but individual patients, must be treated.[1]

The above-mentioned fact corresponds to another of physiology

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[1] The illustrious French clinician, Jaccoud, in one of his later publications (*Leçons cliniques faites a l'Hôpital de la Pitié* 1886-87, Paris, 1888), says almost that he would wish to adopt the above axiom as the motto of his school: "... *ma constante préoccupation a été la comparaison des types cliniques individuels avec les types pathologiques abstraits, cette étude comparative étant l'essence même de la clinique médicale.*" Doubtless the preoccupation of the illustrious Jaccoud is that of all the physicians, who, though endowed with some culture, are not in the least observers. Besides, that which has been the preoccupation of Jaccoud is, as I have already mentioned, a fact of very common observation. Nevertheless, it will not be useless to have recorded what Jaccoud has recently written, especially as, according to his own testimony, new knowledge can be derived from knowing how to individualize the clinical fact. And now I ask the illustrious Jaccoud, Must we be always content with the verification of the *individual clinical types?* or cannot something else be derived from the notion of the variety of clinical types ? For example, the scientific task of at least initiating investigations for the interpretation of the individual clinical types. I shall be delighted to discuss this point with the illustrious Jaccoud, who, after having for so many years illuminated the obscure career of the clinic with his splendid clinical teachings, certainly will have understood that the nosological varieties are infinite, and that to the clinician are necessary scientific principles and rules of practice capable not only of enabling him to recognize the clinical individuality, but also of indicating its scientific reason and physiological mechanism.

—namely, that in the variety of the human species, besides the races, the *individuality* is distinguished.

And all this corresponds to the principle proclaimed by biology, —namely, *variety is the law of the being.*

Wherefore, in the presence of the sick man—that is to say, in the presence of the nosological variety—one feels the necessity of possessing first of all exact knowledge of the individual on whom one has to investigate the genesis of the morbid state and the mechanism of the symptoms.

Dominated by these thoughts, I wandered eagerly, uncertain among the most arduous difficulties, in search of some assistance, of a guide to procure me the knowledge which I judged indispensable. After having put to the proof all the averages that the anatomists and anthropologists had tabulated in relation to the development of the whole body and of the organs, I found them useless for my purpose. On the other hand, everything went to demonstrate the fact, to-day very certain, which concerns *individual differences.*

Finally, having consulted the principles of morphology that I shall now briefly expound, I discovered a method of examination which, after innumerable tests, I find corresponds to some requirements of the clinic both as regards the diagnosis and treatment of diseases.

The proportions of the human body depend, as is known, on the development of its organs ; and as the proportions, so from the organs as a whole the physiological value of the body is derived.

What is the law which governs the development of the organs and of the organism ?

Serres writes "that comparative anatomy is embryology in the permanent state, and that embryogeny is comparative anatomy in the transitory state."

All the recent discoveries of morphologists have clearly illustrated this sentence of Serres, expressed by Haeckel in the following more scientific but equivalent formula : *Ontogeny* (the development of the individual) is a brief recapitulation of *Phylogeny* (the development of species).[1]

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[1] Haeckel, *Anthropogenie oder Entwickelungsgeschichte des Menschen,* Leipzig, 1877.

The law which we are in quest of is clearly written in the history of the development of the *Cœlenterata* and of the animals which in the ascending line, according to the principles of evolution, are met with up to man.[1]

This law was proclaimed by Haeckel when he admitted that the vascular system and the visceral cavity (cœlom) are so indissolubly related to each other that one can say that this cavity in its primitive appearance is nothing but the origin of the vascular system (*Die Gastraeatheorie*, etc.: *Jennische Zeitschr.*, B. viii., 1874).[2]

This law was subsequently confirmed by followers of the Haeckelian doctrine, including O. and R. Hertwig, who in an interesting memoir state that "the fabric of the organism and the intimate structure of the tissues are demonstrated by the mode in which their primitive development was effected."[3]

All that which serves to demonstrate what phylogeny reproduces in the development of the individual applies equally, according to Balfour, to the evolution of the organs and the most complicated systems of organs.[4]

The circulatory system, which is one of the most important for our applications to clinical pathology, offers us a very clear example.

In its primitive appearance it is, as we have said, quite the same as the visceral cavity.

This single cavity successively transforms itself into the lacunar system of the *Annelida*, which has much analogy with the lymphatic apparatus of the *Vertebrata*, where the strictest relations with the connective tissue are met with.

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[1] It would be useless to give here the details of embryology, which can be found in treatises *ad hoc*. Besides, it is more conformable to the nature of the book to confine ourselves to general laws and principles. I cannot neglect, however, to recommend medical men to consult the best sources for the fundamental facts from which the proof of the above laws and principles has been obtained.

[2] In all the Metazoa there is a primitive, equivalent homologous organ, the primitive intestine—that is, the intestine in its more elementary form. Therefore at this stage of initial development all animals represent the *Gastrea*; in other words, one can say that the lowest of the higher *Invertebrata*, such as the mollusca, echinoderms, zoophytes, descend from the Gastrea.

[3] O. Hertwig u. R. Hertwig, *Versuch einer Erklärung d. mittleren Keimblatters: Jennische Zeitschrift f. Naturwiffenschaft.*, B. v., I. Heft, 1881. See also O. Hertwig, *Lehrb. d. Entwickelungsgeschichte d. Mensch. u. d. Wirbelthiere*, p. 114, Jena, 1888.

[4] Balfour, *Traité d'embryologie et d'organogenie*, translation by Robin, Paris, 1863.

Consequently, one can maintain that the connective-tissue lacunæ of the *Annelida* constitute a circulatory system which declares itself more formally in the lymphatic system.

Higher in the zoological series contractile hearts are added to the lymphatic system ; higher still we come to the bloodvessels and the heart, while the pulsating hearts, losing their utility, disappear from the lymphatics. The vessels, says Gegenbauer, are a differentiation of the lacunar spaces.

Therefore, considering the superior animals, including man, one can assert that in the construction of their organisms the great circulatory system is constituted by the connective-tissue lacunæ, the lymphatics, heart, arteries, and veins.

One can assert that this system, like every other, is the result of the evolutionary process, which reaches its perfection by means of the division of work. Further, in man it may offer both in its whole or in its parts variations which concern those anomalies of formation either in the way of excess or defect of development in some of the component parts.

Excesses and defects which in man remain as traces of the law of atavism ; as morphological phenomena special to the lower animals that temporarily manifest themselves in the different phases of human development.

Haeckel summarizes the phases of development of the human embryo in a table which explains my assertion. In the first phase the human embryo is a simple *Plastid* which passes to the stage of *Cytod*, and therefore of *Cell ;* in the second phase man is a multicellular animal, constituted of a large number of cells not yet differentiated into germinative layers ; he is an*Idorgan* which passes into the subsequent stages of *Morula* and *Blastosphere* (the Morula is the result of the process of segmentation of the ovum, a process which is identical for the lower animals and the highest, including man) ; in the third stage man appears as an invertebrate provided with an intestine, and passes through the stage of *Gastrula*, whose organization is that of a worm, analogous to the larvæ of the actual *Ascidians*—four germinative layers fused in the median line ; finally, in the fourth phase, man is a true *Vertebrate.* But he does not yet differ from that of all the other Vertebrates—reptiles, birds, mammifers ; he must pass to the stage of the animals *Acrania*, when he resembles the *Amphioxus* completely developed ; to the stage of the animals *Craniota* without a maxilla (as a Myxinoid and a Petromyzon) or a member ; to the *Ichthyoid* stage, in which the human embryo has the organization of a fish ; the members in the form of fins are rudimentary, the branchial clefts are open and separated by the branchial arches, of which the first pair are differentiated into the upper and lower maxillæ, and from the intestinal canal the lungs and pancreas are derived ; to the *Amniotic* stage, during which the human embryo acquires the organization proper of a higher vertebrate animal.

If we all have a heart, arteries, veins, lymphatics, connective tissue, we all, on the other hand, have not the same parts equally developed, in all these parts do not unite in the same proportions to form, for example, the liver, spleen, lung, and so forth.

Hence the necessity of considering in the morphological variant the physiological variant, or the organic function with the consequences that are derived from it, according to the principle which says that function creates the organ—implicitly modifies the organ—consequently creates a special morbidity.

Through all this the organ in its complexive development represents a primary fact, which is the primordial and successive growth of the vascular elements that determine its first appearance and final evolution ; and a secondary fact, which is the function.[1]

It is also necessary to say with Haeckel that physiologists have studied very little the functions of development as well as the development of functions.[1] And perhaps on this it depends that the clinic, being inspired by physiology, has not yet accepted the facts of modern morphology, and that many times, in explaining the origin of diseases and of symptoms, has sought for arguments without and not within the body ; while daily experience teaches me that they must be sought both within and without it : because, having recognized a morbid cause, it is necessary to know how and why the organism, which in its special morphology hides special functional, and therefore also morbid tendencies, reacts.

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[1] The structure of the functioning substratum determines only in part the nature of the function ; for there are apparatus morphologically equivalent which fulfil different functions. And, on the other hand, there are different substrata that are endowed with identical functions. The less a substratum is developed, the more fundamental functions it possesses ; while the substrata endowed with a single function are met with only in the animals in whom the highest degree of differentiation has taken place. One can express himself also as follows : Several functions with an inferior degree of development have a common substratum ; a function with a superior degree of development has a substratum which appertains to it exclusively. In general, it is not the function that is originally determined by the structure of the substratum, but the structure of the substratum by the function ; since, for a general condition to manifest a physiological function, it must be that which is capable of functioning (substratum) become modified by external agents (stimuli). By means of this reciprocal action between the substratum and the environment, the primitive organic forms can develop from the same protoplasm, because when the substratum under the action of different causes is no longer sufficient for the function, it progressively transforms itself (Preyer, *Eléments de Physiolog. générale*, Paris, 1884).

And I say special morbid tendencies, and not special morbid tendency, for the organism, owing to the fact considered in different individuals, may offer different morphological types. One must hold it to be constituted of parts which individually present morphological varieties, the function of each one of which, in the presence of ordinary and extraordinary stimuli, may deviate from the normal type. This general conception, derived from observation, ought to have induced the physiologists to modify their practical ideas, freeing them from every taint from every doctrinaire note. Some physiologists, it is true, receive inspiration from the clinic, but now the clinic and morphology agree in the conception of medical reform, the former showing its special aspirations, the latter indicating the way to realize them.

One cannot deny this able intuition of the clinic. I wish that those would think who have the habit of asserting that we do not know how to treat patients, nor to penetrate into the realm of science. Nevertheless, not a few problems have been proposed by the clinic to physiology. Some biological facts have been discovered especially by the clinic. It is necessary to distinguish the clinician from the clinic !

Having placed the clinic on the new path, we have responded to the appeal of naturalists such as Geoffroy Saint-Hilaire, Seres, Bichat, Darwin, to whom we owe the principle of the *balancement des organes*, of *anatomical correlations*, of *correlations of growth*—the goal of the profound aspirations of the clinic.[2]

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[1] It is necessary, says Preyer, to rehabilitate general physiology, studying organisms in the evolution of species (phylogeny) and in their individual evolution (ontogeny).

[2] By the expression *correlations of growth* those modifications are indicated which take place in an apparatus or in an organ, and induce sensible alterations in other apparatus and organs, even when these latter have not direct and apparent relations with the former (Darwin). It is hardly necessary to record here as

These principles, though variously enunciated, are equivalent, and are deduced from observation of the phenomena of the organization, which I shall recapitulate as follows :

Every organized being is the sum of the parts of special apparatus which are in morphological and physiological relation with one another.

None of these parts can be modified without the other parts being modified in consequence ; for the functional correlation of the apparatus is the law which maintains the organism in its vigour.

Therefore such relations must exist between them that, when some are known, the others can be inferred.

The degree of development of the different parts of the body being known, and the relations in which they are found established, one can conclude on the state of morphological harmony or discord, or otherwise, on the individual constitution.

These principles have the same importance and efficacy both in physiology and pathology. When applied to the organism immediately it is born as well as in any other age of man, they have the same value, for the modifications which the organism undergoes during the different ages according to the law of adaptation in the environment are the result of the reciprocal influence that the different apparatus exercise on it—otherwise of the morphological correlations.

From these principles are derived the following corollaries :

1. *All that which in the individual indicates a morphological discord, or an anomaly in the process of evolution (ontogeny), is the source, or may be the source, of morbidity.*[1]

2. *The individual is transformed incessantly according to the principle of morphological and functional correlations, and to the law of adaptation in the environment,*[2] *and therefore he may offer different morbidity in the different epochs of life.*

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examples of parts which have no apparent relation with one another the very notable relations that exist between the development of the genital parts and other parts of the organism, between those of the larynx and those of the genital organs. As regards the organs united by direct relationship and visible anatomically, while it is unnecessary to give examples of them here, we shall see in its place the application of the principle to pathology.

[1] Every anomaly of an organized form, especially if living, is of great interest in physiology.

[2] Adaptation is a consequence of the excitability and variability of living beings. Every function must undergo by adaptation considerable modifications ; owing to excess or defect of excitation, it may cease to exist ; owing to alternation

3. *In every epoch of life the principle is applicable that the cause of a special morbidity resides in the special morphology of the organism.*

These corollaries are not only the emanation of a premise which is fully sanctioned by modern science, but also the result of clinical experience, as we shall prove.

Further, we can say that, as at one time clinical observation provided material useful to the development of physiology, so we can now, owing to the result of long experience, confirm and explain the foregoing morphological corollaries which are the foundation of modern physiology.

THE ANATOMICAL AND ETIOLOGICAL DIAGNOSES ARE INSUFFICIENT FOR THE SUPREME SCOPES OF THE CLINIC IF THEY ARE NOT ASSISTED BY MORPHOLOGY

THE principles mentioned above, applied to the needs of clinical medicine, strengthened in me the conviction that a method of investigation by means of which one could understand the special individual organization in its reality would be useful.

However, I must confess that, although medicine has made real progress, substituting for the *empirico-clinical diagnosis* the *anatomical diagnosis*, in the majority of cases this is not the supreme desideratum of the science.

The anatomical diagnosis by itself alone does not tell us why, *cæteris paribus*, the same organic disease in different individuals

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of work and repose it persists ; while under the action of unaccustomed influences its substratum may be essentially modified (Preyer, *loc. cit.*).

"If we consider life as the concordant manifestation of a sum of phenomena determining one another according to given laws, no activity of one organ independent in itself can be imagined. . . . A modification which has taken place in one organic system gives rise contemporaneously to corresponding modifications in a variable number of the other apparatus. These, therefore, are adaptations and changes, which in their turn are derived from adaptations" (Gegenbauer, *op. cit.*, p. 61). "The estimation of the adaptations is based essentially upon physiological principles" (*loc. cit.*, p. 62). Lamarck was the first to express as follows: "When an animal determines any action whatsoever, the organs which have to perform it are stimulated by the influence of a greater afflux of nutrient liquid, and the reiterated repetition of the same function develops, and even creates, the organs which are necessary." In these thoughts one finds, not only the theory of the transformation of species, but also that of the evolution of the individual who thus from age to age can be transformed.

is followed by different complications and morbid successions—why, for example, an affection of the heart becomes aggravated owing to the great increase of the symptoms of the digestive apparatus ; another owing to the sudden appearance of renal symptoms ; another to the unexpected or periodic appearance of respiratory phenomena ; another to these exquisite functional alterations of the heart depending upon spasm or paralysis ; or those others, mild but assiduous and fatal, which with exceptional clinical manifestations kill the patient.

The anatomical diagnosis alone does not explain to us why in some cases of hepatic cirrhosis hæmorrhage is profuse and frequent, while in others it is very slight or wanting altogether ; why the hæmorrhage occurs in one part in some cases, and in another part in others ; why the same cirrhosis is not always complicated with peritoneal alterations, the portal circulatory obstruction being always grave and increasing ; why the external and internal serous effusions are sometimes abundant, at others not, independently of possible hæmorrhages ; why the collateral circulation is not always equally free and in the same venous paths ; why what is called atrophic cirrhosis and what is called hypertrophic cirrhosis follow the action of the same causes.[1]

The anatomical diagnosis does not explain the different modes in which the ordinary tubercular alterations in the lungs declare themselves ; why in some patients it is preceded by the chlorohæmic state, in others not ; why in some the disease is ushered in with sudden and profuse hæmoptysis, while in others this is wanting altogether or supervenes as an epiphenomenon complicating the final phases of the morbid process ; why others present functional disturbances of the heart, or are oppressed above all by the size of the liver, and by the resultant alterations of the digestive and hæmatogenous functions, or die from profuse perspirations.

The anatomical diagnosis of pneumonia does not reveal to us the cause of the collateral congestions compromising the morbid process in one case, absent in another ; the cause of the slowness in resolution of the exudates, or the rapidity of their disappearance in individuals who are classified among the robust or among the weak ; it does not reveal to us the reason by which the abstraction of blood may or may not be indicated, nor the reason of the different modes of behaviour of the heart in the different phases of the morbid process. Many explanations are hypothetical ; those which in some cases go to demonstrate the presence of some morbid phenomena, in others are contradicted by opposite facts.

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[1] In vol. i., Part Special, of "Clinical Commentaries" I have discussed the latter arguments, and shown what we can obtain from morphology to clear up the pathogenesis and the whole morbid process.

We have before us a person whom we recognize as being of lymphatic constitution, but we do not know why the morbid clinical manifestations present themselves in this part of the body rather than in another.

Again, we are confronted by individuals of robust and healthy aspect, but of these some habitually suffer from affections of the pharynx, others from those of the larynx, or of the bronchi, or of the intestines, or of the skin, or of the joints, or of the kidneys. The anatomical diagnosis of these is not wanting, but it interests the clinician to know the reason of the individual sufferings and of their non-causal localization.

Here also there are many hypotheses, but not a single sound scientific reason.

If in the special organization of the body and of its parts resides the cause of the morbidity, it is necessary to know that to justify this.

When both are known the etiological notions will be completed, and the indications for the hygiene and treatment will become clearer.

It is necessary to complete, or better to perfect, the anatomical diagnosis by means of other elements, which represent the special quality of the ground on which the disease has originated and developed.

When this is done, the anatomical diagnosis becomes changed into *morphological diagnosis.* And the anatomico-pathological investigation cannot but correspond to these new scientific aspirations of the clinic.

I do not wish to create a new term, but simply to signify my conception in the best way possible. In reality, if, as there is no doubt, every individual represents a special morphology type, every diagnosis instituted according to the modern naturalistic method will indicate a morphologico-clinical type.

It is not sufficient to speak of, for instance, lobar pneumonia in its first or second stage, with or without complication of bronchial catarrh, but it is necessary to know everything in a patient which offers different morphological attributes—for example, the thorax in smaller or larger proportion, or the heart in proportion more or less developed as a whole, or in one rather than in another part, and so on.

Because to these facts apparently gross, but very important if interpreted according to the precepts of morphology, correspond special conditions of individual organization, of organic function, visceral resistance and susceptibility, which constitute the special nature of the individual type, consequently the tendency to determine morbid manifestations.

When one announces the anatomical diagnosis of caseous broncho-alveolitis, one makes use of a generic expression ; but this will become more and more specialized and concrete if one succeed in associating it with the fact of the disproportionate capacity of the pulmonary artery in respect to that of the aorta, that of the excessive size of certain parts of the abdomen, or that of the particular development of the peripheral circulation.

Whatever be the anatomical diagnosis which one wishes to take into consideration, it will always represent a generic formula, however much it may be specified by circumstances concerning the affected organ. It will be scientific in method, in intention, but incomplete, and will always require to be finally specified in respect to the individual who bears that given alteration.

If one has to deal with a hæmorrhagic focus in the substance of the corpus striatum, the localization is made precisely to explain all the alterations of sensation and motion. But are there not many other factors to know before one can understand why secondary descending alterations take place more quickly in this case than in others ? Who has ever studied the course of the cerebral and spinal phenomena and those of the whole organism in relation with the special morphological conditions ? Without doubt, if, besides the diagnosis of the localization of the morbid focus, we have knowledge of the many other organic conditions which have determined its production, the nature of its course, etc., it will be of advantage to prophylaxis, the treatment, and prognosis.

The etiological diagnosis also, like the anatomical, leaves many questions undecided to which morphology can be applied with the hope of introducing new arguments for their discussion and solution.

We speak of constitutional syphilis ; but if we ask ourselves why in one patient the cutaneous manifestations prevail, in another the osseous, in another the hepatic, in another the cerebral ; why, among the cerebral, in one syphiloma is met with, in another syphilitic arterio-sclerosis, we make only a repetition of coincidences, without a scientific indication of the relations which exist between the definite clinical form and the special morbidity of the tissue, organ, apparatus, in which it has its principal or exclusive seat.

We find remnants of diphtheria in the system of the abdominal or cervical lymphatic glands, or in the nervous system ; but the cause of the individual morbid localizations can be obtained only by the morphological study of the organism, or of its parts where the peculiar morbidity resides.

The anatomical localizations of infective fevers in general—whatever one may do to explain them by means of the dominating hypotheses—and their morbid successions are also problems which await solution by the theories of morphology.

The circulatory alterations with which the trophic alterations in the different tissues originate are likewise the consequence of the *mycoses.* But since during life and after death they are met with now in one and now in another part, it must be admitted that different physiological and morphological factors contribute to these different localizations.

In the infective fevers the efficiency of the general and special nervous system is another factor of no secondary importance ; for the excitation and the depression are connected, not only with intensity of the infection and degree of fever, but also with the individual organization from which the greater resistance or the greater weakness is derived.

Everyone comprehends that, if we succeed in particularizing the generic etiological diagnosis by means of the more active factors of the special morphology of the patient, we shall be more capable of revealing the symptomatic indications and the prognostic signs from day to day.

Many morbid phenomena of the infective fevers do not in reality appertain to the disease, but to the special organization of the patient. In him the disease constantly expresses two factors—

namely, the action of the cause and the reaction of the substratum. And this reaction is what it must be according to the morphological type of the individual, and is highly interesting to know and estimate.

If two persons who have been exposed to the same rheumatic causes afterwards suffer from two different affections—pneumonia in one, pleuritis or endopericarditis in the other—it will be necessary to know not only the cause, the seat, and the anatomical process, but also the reason of the different localization.

If subsequently these two individuals contracted through the same cause a disease of the spinal centre, we shall desire to know why in one the meninges, in the other the medulla, has been principally or solely affected.

To explain the localization of a malady in one organ or in another owing to rheumatic influence, one can invoke idiosyncrasy of the nervous system as I understand it, and as I shall explain further on; but the explanation of the reason why the same cause gives rise to different morbid effects in the same organ—for example, a pneumonia very severe by virtue of the large amount of exudates in one case, and a pneumonia with scarce exudates in another, etc.—can be obtained only from the general and particular morphological knowledge of the diseased organ.

This knowledge, which after all tends to the progress of practice, can be had solely by means of a new method of clinical observation.

It begins at the bedside of the patient, and ends at the anatomical table, where it is necessary to institute examinations which to-day are unfortunately neglected.

The anatomical diagnosis alone and the etiological diagnosis alone cannot be but incomplete, insufficient from the strictly scientific side. Hence they do not fully satisfy the requirements of rational therapeutics.

In the course of my studies I have proposed to myself curative questions several times raised and several times differently solved. And it has seemed to me that they have acquired new importance from the views of modern morphology.

Therefore I have made new experiments, and from the results obtained I am convinced that some indications are understood more clearly, as is the action of the curative means repudiated or adopted systematically.

I allude especially to the indications for general and local bleeding, for revulsives and derivatives.

With regard to them, I can say that their indication in some cases depends not upon the disease, but upon the special morphology of the organism or of the organic apparatus. Consequently, after having been condemned to oblivion, we now see them restored to an honourable place.

He would err who would wish to attribute to me hypotheses of the old pathology, whose systematic ideas I abhor.

It is not to ideas but to facts I cling, to facts of pathology, to facts sanctioned by experience, which have nothing to do with hypotheses.

One cannot deny that in some cases, whether it be of affections of the chest or of the abdomen, abstraction of blood is useful, just as one cannot deny that in others it is injurious or useless.

Instead of taking a side one way or the other to become a *phlebotomist* or an *abolitionist*, I have confined myself to thinking out the reason of the difference in the results, to observing independently the events, and attempting a scientific explanation of the contrary facts by means of the principles of morphology.

Wherefore, being convinced of the truth of these principles, and following faithfully the therapeutic criterion, I believe I am not wrong in declaring that the healing art will obtain considerable progress from the new method.

How much therapy called rational is so in reality? The balsams against bronchial catarrh, the effect of unchangeable conditions; the famous touches with caustic, the astringent waters, etc., against uterine affections which are connected with special morphological conditions of the abdomen; all the specifics vaunted against the tubercle bacillus; the iron cures protracted for months and years; the tonics of all kinds against dyspepsia associated with hepatic conditions ignored and very differently corrigible; iodide of potassium for removing exudates, which, on the contrary, are absorbed by the concourse of more vigorous activities of the whole organism, or for dispersing lymphatic products, which quickly reappear if the general morphology of the body is not modified, prove clearly what I maintain.

In some cases the organism is indeed modified, but insensibly; consequently its changes have not been detected, because the morphological study of the organism has never been taken up for following its phases by means of suitable observations. Meanwhile both the anatomical conditions and the symptoms change, and after a long time disappear; therefore the virtue of the remedy employed with exemplary constancy is proclaimed. But in other cases the same remedy fails. Then blind empiricism suggests another, and for the above reason this also, good or bad, must have its triumph, which history will register among the errors of medicine.

There are, it is true, cases in which, if one remedy does not act usefully, another acts almost miraculously; but I do not refer to these cases, but to those others in which the physio-pathological change is the spontaneous product, so to speak, of the body or of unrecognized circumstances—consequently cases in which the error of observation makes one either a blind therapeutist or an extreme sceptic. In these cases, if we make our observation from a new point of view, we feel our courage revived, for there is open to us a vast horizon completely new, in which we see traced the lines of a more rational therapeutic method—namely, that which is derived as a corollary from the more exact knowledge of the pathogenesis of every morbid picture.

Morphology declares the rules according to which the phases of development of the individual are regularly determined, and makes known the deviations from that rule in some very important facts.

Here pathogenetic factors for the whole organism, for some organs and tissues, become evident, and here many etiological hypotheses find their confutation, and give rise to therapeutic conceptions, as we shall see in the next article.

THE MORPHOLOGICAL DOCTRINES CONTRIBUTE TO THE REFORM OF THE MEDICAL ART

If free from every preconception we study the history of therapeutics, we must confess that a great part of therapeutics reduces itself to many prejudices and a few theories, at whose service there is an immense and increasing array of remedies.

The many prejudices consist in this, that one wishes to find the cause of every malady which afflicts man outside the body. And many of the dominating theories help to perpetuate this desire, which leads to protecting the health only when it is either threatened or lost ; while medicine must be above all preventive.

It is said, indeed, that morbid dispositions concur in the genesis of diseases, but in the long-run one always waits till the malady manifests itself before making hypotheses on the mode of action of this predisposition, which no one has ever sought to know in its essence. I am surprised to see that the recent treatises of general pathology barely mention morbid predispositions, some of them describing obsolete classifications, others reporting summarily the result of the most ordinary medical experience, others simply stating that predisposition has no influence on the process of cellular pathology (!).

When, therefore, one comes to the verification of the predisposing cause, the more one reasons on the effects of the external cause, which is very frequently hypothetical, and if it be real acts in a way that is not always known.

I believe that, excepting special and well-determined cases, it is necessary to follow the opposite direction—that is, to seek first of all for the causes inherent in the organism, and then those others which are external to it. By thus acting we shall be able to persuade ourselves that very many infirmities arise without the work of external causes, that these very frequently assist, but do not by themselves alone give rise to the disease. Thus we shall become aware of the inutility of certain curative methods and of the greater importance of preventive medicine.

Preventive Medicine.—In this expression is included the future of our art, to which the new morphological doctrine will potently contribute.

If I had said hygiene instead of preventive medicine, I would not have precisely expressed my thought. Hygiene, as is known, prescribes general rules which teach us how to improve the environment, to avoid causes, to fortify the body ; and there is no doubt that all this is useful, but it is not everything. These general rules must be applied with special circumspection, which is exacted by the different individualities.

This special circumspection is the result of study by him who is not, however, a hygienist, but an observant physician, capable of recognizing in the special morphology of the individual his special morbidity, and of advising the means by which its efficiency can be cut short or silenced.

It is a future of the science, but a future prepared by modern studies, and placed already on the horizon of the new art. It is not Utopia nor vain presumption.

Preventive medicine must be based on profound knowledge of morphology, of the laws of evolution of bodies in that given way differentiating themselves ; on the knowledge of the method by which the play of the functional correlations can be revealed, and of the method by which they can be modified according to the scopes ; and on the vast knowledge of pathology.

While the theory of evolution has penetrated into historical and social studies, while anthropology is making much progress, why has not medicine received the benefit of that theory ? why is it not transforming itself as the other sciences are ?

This transformation of our science can take place solely by means of the assiduous and logical application of the laws of morphology—practical, not theoretical, application. For if we remember these laws only in the presence of diseases already established, we shall be able to make use of them solely for the explanation of an accomplished fact, and partially also for a therapeutic scope.

This is readily understood when we think that, observing the organism during its development, one can discover its discords, disproportions, functional excess, or defect of the parts, and can conceive the necessary and useful modifications of the environment, habits, alimentation, physical exercise, etc., on which the final beneficial transformation of the body depends.

If, on the contrary, one neglects this very important task of our restored science, having recourse to the art only during the time the symptoms of a morbid condition, which necessarily must be marked by the discordant proportions of the organism, are developing, one will meet with unsurmountable difficulties, rarely the possibility of acting rationally, frequently the necessity of limiting oneself to a purely symptomatic treatment, and the opportunity of convincing oneself that diseases and medicine agree in afflicting some organ or the whole body.

I also know that if we confine our thoughts within the dominion of hypotheses which are not science, and of the common precepts of the art, which are not those founded upon the theories of modern science largely understood and for a long time tested, we shall find at every step one motive or another for distrusting internal medicine, for erroneously thinking that it is an art good for all, and for determining us to practise it in such a manner that it will be a disgrace to the science itself and injurious for the patients.

But we must free ourselves from these humble conceptions ; we must abandon this Utopia which suits the mind only of the ignorant, or of those who refuse to follow the progress of the science, deterred by detestable indolence or by some more detestable intention. We must welcome the flashes of light which help to illuminate our footsteps and advance.

Daily experience teaches us that the nervous, circulatory, and digestive systems become gradually modified as man passes through the different ages of life ; and that these modifications contribute either to the health of the individual, or to disease, or to changing the morbid predispositions.

The factors which co-operate in producing these anatomical and physiological transformations are numerous ; but from daily experience we are enabled to recognize that the action of external causes or of the environment is relative to the susceptibility of the individual organic conditions.

Hence the absolute necessity on the part of the practitioner to verify first of all the individual morphological type, before determining the functional conditions which it specially influences, owing to the powers of the environment.

There are diseases which are special to infancy, others to youth, others to virility, and others, finally, to old age.

Of these diseases, some are due to external causes, others to internal causes, and others still to both internal and external causes.

However, if we consider the facts which I have mentioned, we shall understand immediately that the observation of physicians has been, though unequally, directed to the same. By reason of this some of them have been neglected which, even before now, would have been of value, suggesting useful views.

In general they have neglected to find out why all the individuals appertaining to the different ages have not presented those diseases which are said to be special to them ; they have not made the necessary comparison between the conditions of those who have escaped the diseases and the conditions of the others who were attacked by them.

From this comparison one obtains important ideas and consequent considerations, which lead to the conception of preventive medicine in the sense that I have mentioned, and make one think at least that those who were spared from the diseases owed such advantage to their special individual conditions.

As is seen, if we start from the ideas of morphology and from the result of experience, we arrive at conceiving the ideal of preventive medicine and feeling its necessity.

And in reality preventive medicine suggests the way in which the individual must act to avoid if possible the diseases due to internal causes, besides those that are favoured by external causes.

The following are the questions which, according to the ideas exposed, morphology and pathology propose :

What is the morphological condition predisposing to rickets, and how can it be corrected ?

What is the morphological condition that induces the various lymphatic and scrofulous manifestations in the different ages, and how can it be corrected ?

What is the morphological condition through which the different parts of the circulatory system develop unequally, and through which morbid dispositions may be set up in the organs of the chest, in those of the belly, in the cerebro-spinal axis, in the extremities, and how can they be modified ?

What is the morphological condition predisposing to tuberculosis, and how can it be combated ?

What are the morphological conditions which predispose to diseases of the nervous system individuals who encounter the causes, which others tolerate with impunity ? and how can they be modified ?

What are the morbid conditions owing to which, *cæteris paribus*, some persons become old prematurely, while others have a very long life ?

Are there morphological conditions predisposing to infective diseases ? or are there only some functional anomalies of some organs which constitute the predisposition to these diseases ?

What are the special morphological conditions that tend to produce gout, hepatic affections, renal affections, skin affections, etc. ? and how can these conditions be modified with a preventive scope ?

This is a complex of new problems—problems which besides, after having laid down the general principles of morphology, present themselves on a new scientific basis, and indicate undoubtedly the path which must be followed for their solution.

He who would wish to attribute to me the idea of believing in an altogether ideal progress, and the absurd aspiration of emancipating the human race from every disease, would be mistaken. I know, as well as others, that our possibilities are limited ; but, on the other hand, I know that one can and must progress on the only path of positive science. This science which has improved the races of domestic animals, and transformed them according to social requirements, furnishes us with the fundamental principles for the restoration of the medical art. And our object must be to interpret reasonably these principles, and to practise them according to experience.

All this cannot be the work of one man ; but it can be that a man has the fortune to suggest a good idea, and to call the attention of workers and observers to a new order of facts and questions. The history of the science and art is ready to attest this, and to stigmatize the summary judgments of certain critics who try to confute what is new solely because it is new.

It is certain that, under the influence of the principles and ideas which I have developed, the mission of the physician must become elevated and extended.

And for this to take place it is necessary, on the one hand, that his culture and education be improved ; on the other, that social institutions should gradually adapt themselves to the great requirements of his mission.

To improve the culture and education of physicians scholastic reforms have co-operated up till now, and they will co-operate still more when they become pure emanations of scientific progress instead of personal pretensions, while one continues the study of Nature with febrile activity.

It is now essential to think seriously of the new adaptation of social institutions. The physician should enter the schools and colleges, not to approve of absurd regulations and customs which are precisely the contrary to the requirements of growing youth, but to dictate rules for directing habits, for adjusting the physical and mental work according to the requirements of each individual.

He must be called to the gymnasium and the playground to specify the kind and amount of exercise that is useful and necessary for each. In the schools he, by means of his own observation, must find arguments for convincing the teachere on the special susceptibilities of their pupils, with the object of avoiding erroneous judgments, irrational punishment, causes more or less direct of discomfort, sufferings, excessive work, which greatly perturb the harmony of the organic functions.

The physician must take into consideration not only the hygiene of the school, but also and more carefully the hygienic improvement of the child. Therefore at a fixed time he must register the result of his morphological examination, and obtain from this the arguments for suggesting how the conduct of each individual as regards scholastic, gymnastic, and dietetic operations ought to proceed.

And it is likewise essential that the relations between families and their doctor should be altered. For this purpose a total change is necessary—namely, that the former must give up the idea that they have need of the physician only when signs of disease manifest themselves, and must believe, instead, that while they are in health or apparently in health the doctor's visit will be much more useful.

The physician should visit the new-born babe, then the infant, child, and youth during the periods of growth, with the object of verifying by means of the morphological examination what organic conditions, what functions, must be corrected, and by what means.

The prevention of disease in the healthy and apparently healthy of both sexes and all ages being in question, it will be necessary to watch (always with the best criteria of physiology derived from the knowledge of the individual morphological type) the working of the functions, suggesting circumspection and suitable treatment.

If clients require from their doctor sound judgment and good advice, they must enable him to found his judgment and advice on actual knowledge, which can be obtained, not by the usual visits, but by opportune and assiduous observation of the individual.

And the clients more or less sophisticated and mistrustful, when the physician impeaches morbid dispositions and advises their early prevention, will have to receive his words calmly and prudently without opposing vain prerogatives of birth, without wincing at the revelations of the doctor, without diffidence, without expressing their own opinions, always erroneous, and with the deliberate intention of carrying out diligently the treatment and surveillance on which the progressive improvement of the individual depends.

Preventive medicine can be practised only on these conditions.

I have been asked many times what is the scope of the measurements which obstetricians make on the new-born infant, and if they could not be performed and interpreted better later on. If the measurements are held to signify the maturity of the product of conception, they are generally useless ; if they are taken as criteria for judging the organization of the individual, they are altogether insufficient.

When the physician begins his special observation, he will require morphological data that indicate directly those conditions of the organism for which it is necessary to provide. The measurements that I shall propose will, I believe, satisfy this general requirement.

And if, as I have said, these measurements be made periodically, and if at the same time we collect all the physiological data regarding the functions of the different apparatus, obtaining facts from the family history as to the tendencies of the individual, his habits, and all that which distinguishes his individuality, we shall be able to have important ideas concerning the nervous, digestive, circulatory, respiratory, and other systems.

It is by the careful observation of these particulars that one will succeed in understanding the task of preventive medicine, also the difference between the greatest floridness and perfect health.

It will be seen that the digestive system is among the first to claim the physician's attention : the digestive system which of all the systems is the most capable of adaptation ; the digestive system which one can say, from infancy onwards, is ill-treated by the habitudes followed by all in bringing up the infant, nourishing the child, restoring the adult, etc. ; thus are perpetuated some errors of first formation that later on are more pronounced, and finally become constant sources of discomfort, and even of true diseases.

Why must not the providential principle of adaptation be applied to preventive medicine ? Why is it not applied at the opportune moment to direct by means of the process of nutrition the growth of the other parts ?

It will be seen that certain congenital disproportions of the body are the principal cause of functional anomalies which keep up some morphological relations that must be combated, for they forebode the constitutional defect which later on cannot be corrected.

The abnormally developed stomach that continues to be viciously voluminous, though the individual shows abundance of soft parts, roundness of form, and a florid appearance, must be corrected, because it interferes mechanically with the respiratory and circulatory functions, and consequently affects the hæmatopoiesis, nutrition of the tissues, development of the lungs, heart, and vessels.

Just as the first evolutions of the ovum represent the effect of its nutrition, so the first evolutions of the infant are in direct relationship of dependence with the process of nutrition. Just as in the ovum the distribution of the elements determines the first rudiments of the component parts of the being, so in the infant the nutrition, function, and growth of the organs depend upon the way the nutrient materials are distributed by means of the circulation and respiration.

And if we remember the conception that one must have of the great circulatory system, which includes heart and arteries, veins and lymphatics and lymphatic spaces, we shall learn that from the error which has not been corrected in the hygiene of infancy must arise that error of nutrition and of constitution which owes its special attributes and special morbidity above all to the predomination of the lymphatic elements. These give rise to morbid phenomena in the skin, or in the lymphatic glands or the mucosæ, or in one organ or another.

Things proceeding thus, when at the established time the corporeal measurements are repeated and the relations between the different parts instituted, the disproportions which greatly increase during the course of years, and which give a special form with its morbid inclinations to the body, will be revealed.

From time to time as the individual grows the surveillance of the doctor must extend to all the organic apparatus. The projects of preventive medicine will be more easily fulfilled during the evolutionary phases of the organism than when the individual has reached adult age. This shows the great importance of the rearing of infants, the hygienic education of youths, consequently of the mission of preventive medicine.

This in the erethistic contribution of the child, the palpitation of the youth, in the recurrent epistaxis, frequent diarrhœa, urine often sedimentary, restlessness, irregular distribution of the circulation, enlargement of the spleen, etc., sees facts which indicate morphological and functional want of equilibrium, indications that will suggest the mode of restoring the anatomical and physiological correlations, *le balancement des organes*, in order to cut short those conditions which sooner or later end in true morbid systems.

It consists, then, in favouring the nutrition of the spinal axis, of exercising especially one part or another by suitable gymnastics to distribute equally the energies ; it consists in utilizing the general sensibility to influence indirectly the visceral vaso-motor functions through the intervention of the medulla spinalis ; in developing the muscles of the limbs or those of the trunk according to the scope ; in encouraging the enlargement of the thorax, the nutrition of the left ventricle of the heart or of the whole heart, while with suitable regulations controlling the digestion and all the secretions one will gradually arrive, not only at transforming the organic relations, but also at modifying the movement of the organic materials.

All these things are a product of experience ; no one certainly would wish to doubt what is well known—namely, the successive transformation of bodies during life, the changing of the morbid dispositions and of the physiological attitudes. These are natural facts which, having their root in the morphological conditions of individuals, refer us to these conditions when we desire to influence beneficially the evolution of organisms.

On the basis of these ideas we can now pass in review all the problems on morbid dispositions that I have mentioned, and indicate the way to be followed for arriving at the solution of each problem.

Some—that is, those which refer to acute infective diseases—certainly require other studies, other experiences, which have direct relationship with the individual morphological conditions, together with the transformations of the organic materials, with the greater resistance of these in the presence of infective causes. But all this does not exclude the importance of the above-mentioned views, if we consider well the necessary and strict connection that exists between the function of an organ, the nutrition of the tissues which compose it, and the products that depend upon it.[1]

Preventive medicine therefore has its future.

Nevertheless it is essential to add some other considerations for delimiting, so to speak, its field of action, and for indicating where it is foreseeable that its work cannot, unfortunately, display itself profitably and healthfully.

In the same way that hygiene, no matter how much it may progress, can never suppress those special cosmic conditions which give rise to those scourges which are called "epidemics," so also preventive medicine will never succeed in overcoming in every case those special conditions of the organism on which not only morbid disposition, but also the fatality of the morbid manifestations, depend.

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[1] When one is asked, In what consists the predisposition to, for example, smallpox, typhoid fever, scarlet fever, or cholera ? one has little to say ; and having admitted, with the modern parasitic doctrines, that the cause of these maladies is represented by a special microbe ; having admitted that some persons are susceptible to the morbific action, that others are susceptible in less degree, and that others still, are unsusceptible, one must admit that the quest of the morbid disposition is of the highest importance. At the same time, the following thought occurs spontaneously to the mind : If the microbe find in the former the suitable medium for its pathogenic activity, and do not find it in the latter, it means that the liquids, the organic materials of both, differ, and that they may differ owing to transitory causes, as well as to causes inherent in the individual himself. This seems to be confirmed by the fact that some have a greater proclivity than others of falling into the infective diseases. It is certain that hygiene alone, with its rules and general precepts, cannot provide individual prophylaxis. This should be borne well in mind by those who believe they have saved populations from the scourge of cholera and of smallpox by measures and provisions which scarcely influence the environment. Some preventive vaccinations would seem to support my suggestion. I must, however, confess that they do not fully confirm it. And, with regard to this, it is necessary to observe that the principle on which the practice of preventive vaccinations is founded, while still discussible, to-day tends to be generalized too much, as are equally generalized and imposed the parasitic theories by criteria which are not always very rational. For example, they speak of the contagiousness of cancer, and some anatomical considerations relative to the mode in which cancer is diffused in the body encourage them to persist in researches. Thus Arnaudet, owing to his having observed that cancer was more prevalent in a town in Normandy than in Paris, and having revealed that those individuals were specially affected who had drunk a certain water or had eaten alimentary products prepared with it, believes that he has given us an argument for sustaining the contagiousness of cancer (*Contribut. à l'étude du cancre en Normandie*, Rouen, Dehays, 1890). One understands what method of preventive medicine this author would suggest, who does not believe in distrusting his statistics, and loses sight of the study of the organism to go in search of the microbe in the water consumed by the inhabitants of his town.

Certain organisms are transformable, while others are not so in the least. At any rate, for the present it appears that our art cannot aspire to this ideal.

These thoughts have an importance which is not solely theoretical; they mean that, when putting to the proof the means suggested by preventive medicine, we must carefully select the cases in which the experimental results are positive, and permit scientific estimates and sound conclusions. One must not imitate empirical medicine that employs the same curative method in all the cases which present themselves, and never arrives at positive conclusions, inasmuch as from the same statistics different, and even opposite, conclusions may be drawn.

I believe, for example, that in certain individuals pulmonary phthisis, some heart diseases, etc., can be avoided when the organisms are controlled rationally by preventive medicine. But I must not ignore the fact that certain others, in spite of all, will fall victims to these diseases. Well, if for judging the curative value of preventive medicine I examine the facts taken anyhow, though apparently analogous respecting the primary morbid predisposition, I shall run the risk of concluding in the contrary direction to the truth for various reasons. First of all, because the art is perfectable, not perfect; consequently, as the capacity of the art increases, so also will increase its products both in intensity and numbers. In the second place, owing to the love for statistics, the following axiom would seem to be forgotten: In the experimental sciences one positive fact has greater value than a hundred negative facts. And it must not be forgotten that preventive medicine, when founded upon morphology, is an eminently experimental science and art; that following its natural course it will not only improve its special criteria and special means, but with scientific positivism will reach the capacity of discovering when, where, and how it will have to intervene or to abstain.

This can never be reached by empirical medicine, which even in practising the so-called specific treatments has suffered and is suffering from no rare delusions.

Woe to us if we entangle ourselves in the art, if we begin to dispute about the so-called laws of the art! Many things are done *ut adempleantur scripturæ*, and there are old, new, and very new writings which have all the same value. Solely to obey the books they write prescriptions that are useless, propose questions, feed discords, pronounce sentences and condemnations, and perpetuate a history of errors which makes one wonder why they are not combated in order to initiate the reform of the art according to the theories of the science. According to the art in a given case one wishes to make a bleeding, but according to the art others are against it. The question is decided by the taste of the patient, or by another for him. According to the art one should forestall the disease, sending the patient to the sea, but according to the art one will reach the scope better sending him to the mountains. Fashion decides the question; the most fortunate physician is he who follows the fashion. The result of the treatment is such as it can be, for it is by chance that the cure could have taken place on the mountains or at the sea. According to the art arsenical and other baths, etc., etc. According to the true art, long before one had to think of preventing nervous, uterine, or other maladies by modifying the organism.

But we leave this question.

I have heard some clinicians say that we must put our whole mind on the diagnosis, and only on the diagnosis of the disease, because we can do little or nothing for the treatment, therefore it is useless to trouble about it.

These expressions contain a little of everything—of truth, of exaggeration, of pessimism.

It is unnecessary for me to show the truth contained in them, for the great importance of the diagnosis is known to all. Consequently we admit freely that the diagnosis must come first, and must be studied in order that it be as exact as possible.

But I maintain that it is an exaggeration to say that we can do little or nothing for the treatment. They who deny it exaggerate our impotency, and belittle our therapeutic capacity; above all, they deny implicitly the progress of the art and impede it. He who believes that he can do little or nothing for the treatment falls distrustful into inertia, and laughs at the curative proofs, or refuses the fruit which not rarely the best proofs have borne. Further, he denies—I do not know by what right—the experimental work of the clinic, the rational treatments being nothing but experiments of human physio-pathology.

It is necessary to distinguish the cases, because it is true that in some our work is absolutely useless, in others, unfortunately, of little moment, but in others still, it is undoubtedly useful or essential.

He who maintains that he can found his therapeutic programme on the basis of a very exact diagnosis can, I believe, be confuted by what I have said already regarding the insufficiency of the anatomical and etiological diagnoses ; in fact, the diagnosis must be based on the individual morphological notion.

Again, he who wishes to persist in his therapeutic pessimism will have to know that he lies under a very grave mistake, against which protest the modern views of the science and some splendid results, that are to be included, not among the casual events of empirical practice, but among the phenomena which have been presented, proposed, and determined by the truly rational treatment.

And the error of the pessimists is graver still when one considers that they do not think it possible that therapeutics can take a new path undreamt of by unsound theories, and opened up to us by the knowledge of new general laws—namely, those of morphology and biology. The pessimist is a myope in the field of science ; he does not see the errors, nor even the way of avoiding them, for to see them it is necessary to look a long way into the past and into the future.

To suppress pneumonia, endocarditis, tuberculosis, typhoid fever, smallpox, nephritis, etc., is impossible, and here lies the error in proposing to ourselves the impossible. It is an error which has been professed from generation to generation.

To modify the symptoms and course of these diseases is possible, and it will be more possible in proportion to an increased knowledge of the mechanism of the symptoms, which can be obtained from morphology. This is what experience and science truly teach us, though it is erroneously denied.

I have mentioned above that when internal medicine is summoned to act only when the disease is already determined, it finds itself confronted by an accomplished fact, and consequently less capable of working with advantage.

Nevertheless there are therapeutic questions which can be discussed anew in the field of morphology, with advantage to the art in those diseases which we have said cannot be suppressed.

One of these questions is general and local blood-letting, besides the abstractive treatments.

General bleeding, concerning which the most strange and contrary opinions have been expressed—this method of the art that according to some authorities cures, according to others kills, according to others is indifferent, according to others, finally, is useful and opportune—general bleeding, which it seems to me is about to resume its old place, is for me an object of important discussion, first from the morphological, and then from the pathological, point of view.

In my opinion, general as well as local blood-letting is indicated, not by the disease, but by the patient—that is, by his complex of morphological conditions. Neither inflammation nor fever suggest it, but certain organic types, where the study of the morphological and functional defects between the heart and the vascular system in general, and the vascular system of the affected part in particular, explains facts which cannot be interpreted otherwise—facts which do not constitute the whole of the disease, but colour it and aggravate it in the concrete case ; facts which, when they persist, extend the injurious effects of the diseased organ on the body and of the morbid process in the morbid focus.

Pneumonia, heart disease, broncho-alveolitis, typhoid fever, hepatic cirrhosis, do not indicate general or local bleeding, but in all these diseases it may be indicated by the morphological conditions of the patients.

It is true that blood-letting may weaken the constitution and induce oligæmia, but it can be useful without producing the one or the other.

Therefore to bleed by rule and not to bleed by rule are grave errors.

It should be made only when it is truly indicated, and this can be known, not from the hypotheses which favour or oppose its passage into the dominion of the art, but precisely from the study of the individual and of his morphological and pathological conditions.

When one has succeeded in understanding that in the concrete case the morphological relations of the vascular system in respect to the organ do not correspond to the best type, and through this one can explain the increase of the hyperæmia and of its consequences, as well as the local and general phenomena, then a very secure indication will arise.

But the morphological conception includes other relations besides those directly concerning the vascular system—namely, those relative to the functions of the organs or apparatus which have an antagonistic action on one another, and are subordinate to the vascular system influenced by the nerves ; for example, the functions of the skin and those of the mucosæ and of the kidneys. Well, in each individual these relations must necessarily be inquired into, for in all they have not the same correlative functions. The use of evacuants, diuretics, baths, must be regulated according to the morphological criteria. And this explains the great difference that is generally noted in the therapeutic results obtained according to the general indications of the disease or of the medicamentous action.

A principle of general therapy which I have deduced from morphological conceptions applied clinically is as follows : Where the lymphatic and fatty elements predominate, morbid conditions dependent upon the lymphatic hypergenesis and venous hyperæmia establish themselves; and the treatment must not be limited to the symptoms proper of the disease, but must correct the original morphological condition of the parts.

Therefore many skin affections, many visceral hyperæmias, many catarrhs, require a much more rational treatment than what suggests itself. As a rule, to the complex of morbid phenomena dependent on the above-mentioned morphological condition a character of weakness is attributed ; consequently a reconstituent diet above all is recommended, and then one has recourse to remedies of problematic action. But in spite of all this the affections pass into the chronic stage. When they are cured one cannot credit it to the treatment, because this is interrupted, or is made irrationally, not being accompanied by all the hygienic precautions that would have assured its effect even in cases in which it would have been clearly indicated and efficacious. Besides, it is frequently varied in such a way that common sense refuses to take it into consideration for demonstrating how the salutary effects were produced. In reality the cure is the result of a change which has taken place in the patient, who has lost or modified in some way the anomalous morphological relationship of his parts, and hence the functional correlations that depend upon it are slowly modified in their turn. These spontaneous cures which are made in time show what therapeutics has to learn from morphology.

This withdraws from the control of a fatal apriorism the practice of alimentary hygiene, which has the greatest importance in every moment of life, and especially in infancy, to subordinate it above all to the conceptions of biological chemistry derived from the morphological study of beings, and therefore to the laws of functional correlation. And in this also we may expect a good deal of progress. Many kinds of treatment are successful only when the diet is adapted to the real requirements of the individual. And this dietetic adaptation rarely occurs through the work of positive, scientific precepts. Not rarely it takes place owing to a kind of individual election, which contrasts with the professed theories, and obeys those laws that I have mentioned, and that, if they are not known, are easily violated.

Using systematically all that which, according to gratuitous criteria, constitutes a restorative, reconstituent diet is an error of alimentation. What happens ? That which is introduced may be digested and absorbed. Before one can know this it is necessary to take into consideration the different functional capacities of the individual, because in all the disposition and capacity of the circulatory system in general, and of its visceral provinces in particular, differ ; the cardiac function differs, the hepatic and renal development differs ; so also the development of the lymphatic elements here and there in the body, and the nervous and cellular activities differ. If the reconstituent diet be not inspired by the exact notion of these physiological factors, it will encourage the production of morbid phenomena in the digestive apparatus, or in the skin, or diffusely in the organism, tormenting assiduously one or another organ. There the therapy will not progress, unless it be inspired by the laws of morphology, applying to the reconstituent dieta conception derived not only from the knowledge of the chemical composition of the aliments which theoretically we considered the best or necessary, but also from the knowledge of the special individual morphological conditions to which special requirements, consequently an alimentary method proper, correspond.

It is necessary to persuade ourselves that the materia medica cannot correspond to all the requirements of the art with the quest for new drugs and the study of their physiological actions carried out, as a rule, on the lower animals. Besides this, we require methods founded upon the natural laws of organisms, rules for the application of curative methods according to the individualities, and this can be derived only from the knowledge of the general and special morphology of man.

We have to treat, for example, a disease of the heart, of which we know exactly the pleximetric and stethoscopic facts, the special irregularity of the cardiac function, and the peculiarity of the pulse. We begin with digitalis, then we try strophanthus, caffein, strychnine, and obtain a certain functional equilibrium, and we remain satisfied, for the value of the remedies has been more or less verified. But we have not done everything that the science suggests; we have not sought the explanation of the reason why the heart as a muscular organ, variable in its power in all individuals, corresponds to the kind of affection, nor the reason through which so many subjective and objective symptoms have presented themselves. We have not investigated the cause owing to which some nervous, respiratory, hepatic, hæmorrhoidal, or renal phenomena have suddenly declared themselves. The morphological examination made before the symptoms had become so violent would have indicated their possible appearance, and shown the necessity of preventing it. As is seen, all this must enter into the physiological research guided by the principles of morphology. It is only when this is done that the value of medicaments can be more rationally investigated.

I might give other examples which I have met with in practice, but I must bring this argument to a close, which is, I think, in itself sufficiently clear and important. I would say also, as difficult as it is important. But the difficulties, instead of checking the aspirations of the art, should encourage them. What signifies is to enlarge the truly scientific basis of therapeutics, *extending the knowledge of the indications beyond the field of the symptoms into that of the facts, investigated in the individual organic conditions, according to the principles of general and special morphology.*

PART II

MORPHOLOGY CONTRIBUTES TO THE DOCTRINE OF PATHOGENESIS

The anatomical and the etiological diagnoses united do not give exact and full knowledge of the morbid genesis ; in studying now to prove that *the cause of the special morbidity of the body resides in its special morphology*, the argument of the present chapter will become clear, for the necessity of placing the diagnosis of the individual morphological type before the etiological and anatomical diagnoses will be demonstrated.

When one proceeds to examine an individual, any patient whatsoever, one starts with the idea that to the body as a whole and to its parts are applicable certain anthropological, physiological, and pathological criteria which are the so-called media.

In the general examination of the patient everything is taken in the lump—for example, *skeleton well developed, proportionate ; musculature weak or robust ; panniculus adiposus scarce or abundant ; neck short and thick ; thorax well made ; belly of normal form*, etc. Finally, one concludes qualifying the constitution strong, or weak, or lymphatic, and so on.

If this general examination be made for the scope of recognizing the qualities, so to speak, of the soil in which the disease has grown, it is necessary to state that from the notes taken very little or almost nothing can be obtained.

Many things which have been registered will have, not a morphological, but a semeiotic significance. They indicate more or less clearly that a morbid process exists in the organism, while it is quite as essential to know the morbid tendencies that are concerned in the disease.

Others would aim at revealing the special attitudes of the body, but they are extremely vague, and very frequently in perfect contradiction to the morbid facts. For example, the expression *panniculus adiposus abundant* is tantamount to giving a reassuring idea of the general conditions of nutrition; while it may coincide with morbid phenomena that, as we shall see later on, also recognize their reason of existence in the morphological cause owing to which the *panniculus adiposus* is abundant. Thus, also, the expression *belly of normal form* is employed for indicating the absence of deformities or anomalies of form in respect to what the belly of the patient was before the disease; while that belly considered in its different regions, as we shall show later on, represents a variety of form to which definite morbid dispositions and the relative sufferings are connected.

To-day the science requires something more. When examining a patient, it enjoins us to investigate if by chance he do not bear some phylogenetic note, or, in other words, if his intra-uterine evolution reached its final phase normally; or if, during some stage, an excess or defect had not occurred in some parts; if the evolution had regularly progressed in the successive phases of extra-uterine life; if special adaptations had taken place.

And all this is due to the fact that *that which denotes an error in the evolution of the organism, or of some of its parts, is an element of morbidity.* This is demonstrated to us by teratology.

I. A GLANCE AT TERATOLOGY.

Blanchard, in a very valuable work, has collected a beautiful series of facts that illustrate the sentence of Serres which I have already quoted—namely, that "the organo-genesis of man is a transitory comparative anatomy." I have taken from this work the facts which are useful for my scope.[1]

In the majority of quadrupeds the cerebral convolutions leave impressions on the internal surface of the cranium which are sometimes so very pronounced that one can value sufficiently the morphology of the brain by looking at these impressions. This characteristic in monkeys gradually disappears as we go from the lowest to the highest. In the white race of man they have completely disappeared. Therefore the presence of cerebral impressions on the vault of the skull is an atavic characteristic, as is shown by the following facts : (1) All the skulls of primitive races present these impressions ; (2) in the higher races they present themselves solely in idiots, microcephalous individuals, or those who have undergone some arrest of development.

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[1] Blanchard, *L'atavisme chez l'homme. Revue d'anthropologie*, 3ª serie, tomo 8°, 1885.

The ossification of the cranial sutures occurs in a different way in the higher and lower human races. In these, as in monkeys, it begins in the fore part of the skull, and indicates the slight development of the anterior cerebral lobes. In the higher races the converse takes place; consequently in them the development of the front part of the brain is greater. This is a characteristic of superiority of race. In degraded individuals of the white race ossification occurs as in the lower races and monkeys, and as is met with in microcephalous individuals.

I shall not refer to the skeletal monstrosities observed in the skull, face, vertebral column, and extremities, because, though they have great importance for the theory of descent, they do not concern pathology directly.

The human liver, as regards the general disposition of its parts, is identical with that of the orang-outan, chimpanzee, and gibbon ; the left lobe is not divided, and the lobulus caudatus, which is found in quadrupeds and reaches large dimensions, is absent.

This signifies that the liver is larger in quadrupeds than in the orang-outan, chimpanzee, gibbon, and man ; that when in man the liver presents an analogous disposition to that of quadrupeds we shall have a case of atavism. This constitutes in man an abnormal morphological condition which, as we shall see farther on, bears with it a definite morbidity.

With regard to the liver, I wish to induce the reader to consider well a fact which up till now has not been sufficiently appreciated.

As results from the above, it is necessary to have broader ideas concerning anomalies of development of the liver. This organ represents, not only when it is subdivided into several lobules, but when as a mass it exceeds the proportions proper to man, an anomalous condition, a morphological variation, that in the measure with which it declares itself ought to be the object of special study by the morphologist rather than by the teratologist.

When the liver is more or less subdivided into lobules, and thus presents a phylogenetic note, or when apart from previous disease it is larger than normal in an individual, it can well be considered as an anomaly of ontogenetic development.

It is known that the liver after birth bears itself in an absolutely contrary way to that of the heart. This up to adult age continues to increase in its proper proportions ; that, on the other hand, in the fœtus of from seven to nine months is found more developed than in the new-born infant ; up to the age of fifteen years it has not reached, according to Birch-Hirschfeld, the proportions relative to the body recognized as normal. This means that even in embryology we find useful arguments for the physiological and pathological study of the hepatic functions, solely reflecting on the different procedure of the evolution which is observed in different individuals. The averages regarding the size and weight of the liver in relation with the corporeal development represent the subject which must occupy our attention—that is to say, the greater or less development of the organ in every individual—to establish whether there exist or not hepatic proportions greater than those which are normal to the body. *Congenital hypermegaly of the liver* is a teratological condition which constitutes, according to the cases, a particular kind of morbidity, as we shall have occasion to demonstrate elsewhere by means of the positive data of clinical experience.

If we enter still further into the knowledge of the organization of the liver under the guidance of comparative anatomy, we shall find other arguments (of which I shall speak in their place) to justify these general conceptions from which, as a corollary, one derives the fact that, morphologically speaking, there are varieties of physiological hepatic function and of morbid disposition in the liver and in the whole organism.

In the first edition of this book I said that, concerning the spleen, I had found neither facts nor observations analogous to those recorded for the liver. Now, on the contrary, I can state that I have met with some clinical observations which have led me to propose to myself the following consideration : If, owing to the spleen being habitually multiple in the dolphin and marsupials, we can infer that it is more developed in these animals than in others, can a phylogenetic condition and corresponding morbidity be verified in man when this organ is proved to be abnormally developed independently of previous disease ?

Inasmuch as I shall deal with these clinical observations in their place, it is sufficient for me now to say that in some cases one can undoubtedly observe the liver and spleen, disproportionately developed, associated with definite morbid dispositions.

On reading over these pages, I am induced to admit that there are cases of *congenital hypermegaly of the spleen* with symptoms relative to special morbidity, and that there are also cases of *congenital hypermegaly of both liver and spleen* which up to now have escaped the observation of pathologists. Therefore some clinical pictures depending upon them have been regarded from a false point of view, and in consequence considered as the basis of reasonings which have led to unsustainable theories.

I allude to certain pathogeneses of hepatic diseases, the so-called Banti's disease, etc.

Some anomalies of development of the vascular system are explained by the teachings of morphology.[1] Farther on we shall see the most important facts which refer to the heart. Here we shall briefly state that embryology explains the reason of certain anomalies of development of the vessels in man ; for example, the aorta double, which is transitory in the human embryo, permanent in chelonia ; the arch of the aorta to the right, as is found in birds, etc. I do not mean by this that all anomalies or variations of development represent dispositions special to the lower animals. Many of these anomalies have perhaps primitive phylogenetic origin, but in their mode of final development they depart from the original type, and then represent ontogenetic variations that cannot be easily explained. For instance, two arterial trunks are given off from the arch of the aorta in monkeys, carnivora and lemurs (the innominate trunk which gives off the right subclavian, both carotids, and left subclavian) ; in man, on the contrary, we find three (the brachio-cephalic trunk, left carotid, left subclavian), and thus also in the chimpanzee and gorilla. Well, as variations in man we may see two instead of three trunks departing from the arch of the aorta ; two trunks only as in monkeys, carnivora and lemurs, but with this difference, that, instead of there being one innominate trunk on the right and a subclavian on the left, the two carotids and the subclavian are together.

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[1] O. Hertwig, *Lehrb. d. Entwickelungsgeschicht. d. Mensch. u. d. Wierbelthire,* Jena, 1888.

Sometimes in the cervical region we observed one or more congenital fistulous openings which communicate with the cavity of the pharynx. Well, these fistulæ are found in the place where in the embryo the branchial fissures existed, on whose incomplete closure depend the persistence of a portion of the precervical sinus, and consequently later of these fistulous openings (Hertwig).

What have we to say regarding the innumerable variations of development of the circulatory apparatus considered (*a*) in the arterial, venous, and lymphatic systems, (*b*) in the different parts of the body ? This is an order of facts of the highest physiological and pathological importance which has never been taken into consideration, but which, owing to the data that I have deduced from pathology, I am convinced help to constitute many factors of morphological variation.

The intestine presents numerous and frequent variations of development in respect to length, and, besides, one knows the anomalies of position and of calibre that are met with. All these factors, not to speak of others which represent teratological manifestations more or less incompatible with existence, are to be explained by means of the reasonings offered us by embryology, while they constitute important conditions for the individual in whom one of these anomalies of development exists.

Bichat was the first to observe that the digestive capacity varies according to the development of the intestine.[1] Klebs justly remarks on the different importance which is connected with the anomaly of development, according to whether it occurs in the small or in the large intestine ;[2] and through this one can maintain that the research initiated by Beneke, unfortunately interrupted by his death, is fruitful of application.[3]

Although the stomach of man and that of anthropoids do not offer very marked differences, still, there are some concerning the dimensions which would be very interesting to know and to value.

The length of the intestine is in relationship with the alimentary régime of animals. It is said that in man it has a length equal to from six to seven times that of the body, in anthropoids from seven to eight times. Anatomists have also revealed the very important

[1] Bichat, *De la vie et de la mort.*

[2] Klebs, *Handb. d. patholg. Anat.*

[3] Beneke, *loc. cit.*

fact of anomalies of development of the intestine regarding its length. But they have not as yet instituted researches which would provide new applications for comparative physiology and pathology, and for the clinic. Nevertheless we must hope that our wish will soon be satisfied, now that this kind of research is more appreciated than it has been in the past. We see, for instance, as regards the *colon* : one can say that it offers many variations of development, and presents extremes which may be called monstrosities; and that their cause is certainly found in the phylogeny, inasmuch as the function of the intestine corresponds to its development. And at the same time we know that the colon can be considered as an acquisition of the series of mammifers; but in them it offers different degrees of development which are in relationship with the kind of alimentation. If after this we reflect on the many variations which man presents regarding the function and morbidity of the intestine, we shall understand what light may await us from the possibility in which we shall find ourselves of judging if in the concrete case the extreme length or shortness of the colon will help to explain the phenomenon taken into consideration. The same can be said of the cæcum, an anomaly of which that represented what is observed in the horse has been described by Ciniselli.[1]

II. A GLANCE AT COMPARATIVE ANATOMY AND PHYSIOLOGY.

Naturalists unite man and monkeys in a common order in such a way that in the order of *Primates* man constitutes simply a *family*.

The characters common to the beings who appertain to the order of Primates are as follows :

(*a*) Human form.

(*b*) Permanent teeth, in number thirty-two or thirty-six, equally distributed and disposed in the two maxillæ.

(*c*) Two pectoral mammæ.

(*d*) Cranial cavity roundish, within which is found the tentorium permanently membranous.

(*e*) Morphological analogy of the brain.

(*f*) Parallel direction of the optic axes, owing to which the Primates alone can be said to have a face.

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[1] Ciniselli, *Due casi di prima formazione del grosso intestino. Riforma medica*, February 13, 1890.

(*g*) Orbital fossæ complete, non-communicating with the temporal fossæ.

(*h*) Chest broad ; a character common to the animals whose thoracic members are not solely for locomotion.

(*i*) Upper extremities kept at a distance by means of a long clavicle ; arm free in all its extent ; forearm composed of two bones movable on each other, and separate in their whole length.

(*k*) Lower pelvic extremities constituted by the free thigh and by the leg formed of two bones, but not movable on one another.

(*l*) Differentiation of the hand and of the foot considered anatomically : hand with five fingers, of which the first (thumb) is almost always opposable ; foot plantigrade, with the digitiform appendages separate and movable.

(*m*) Stomach simple.

(*n*) Cæcum short.

(*o*) Testicles situated in the scrotum, and penis free.

(*p*) Uterus simple and pyriform.

(*q*) Placenta of discoid form.

While the beings who possess these general characters realize the homogeneous type which we call anthropomorphous, the individuals representing the four families of the order of *Primates* offer numerous modifications of type more or less relevant.

And in the same manner that, when discussing the primitive organization in general, we had to fix what is special to the lower animals, in order to comprehend the value of certain morphological facts in respect to pathology, so now, from the observation of other facts which refer to the differentiation of the parts of the body that chiefly interest us, we desire to obtain what will be of advantage to the clinic.

It is natural that our research is to be confined to the order of Primates and to the races of the family to which man appertains, for whatever be the error in the primitive organization of the being, the mode of differentiation of the parts follows the law of evolution of the order to which man belongs, as well as the direction of the phylogeny.

It is understood that in our review we shall dwell only upon the facts which are most important and useful for our scope—that is to say, those which directly or indirectly can offer arguments for the general law of pathogenesis which we have formulated—namely, *that which expresses an anomaly of evolution may be the* *source of morbidity.* And they demonstrate a great truth asserted by Virchow, that every ethnological form finds its equivalent in general pathology.

Unfortunately our knowledge on this question is scarce. That which we possess concerning morphology has never been directed to solve the problem of pathology. Human genealogy enables us to see the passage from the Monera to the Gastrea, from the primitive Worm to the Craniota, from the primitive Fish to the Amniota, from the primitive Mammifer to the Monkey . . . to Man. But we do not possess the complex of verified facts which would enable one to write special works of physiology and pathology. We have, however, general conceptions which meanwhile enable us to undertake new researches on this line. Gegenbauer says, for example, that *regression* is a phenomenon of differentiation of the being, owing to which organs and organisms pass back to relatively inferior stages. Then, with regard to the whole organism and to its relation with others, regression has a result analogous to that of differentiation, and contributes to the variation of forms.[1]

Therefore, when dealing with man, it is not sufficient to know his embryological history, as it is also necessary to know the natural history of the human races, to compare the comparative morphology and pathology of the races, without which pathology for the part which depends upon it will seek in vain for the explanation of the facts which are due to the individual organization, otherwise to the special differentiation of the individual.[2]

Hence we wish to follow this line which science has indicted.

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[1] Gegenbauer, *Manual. d'anatom. compar.*, p. 59.

[2] I have pleasure in recording here the ideas of M. Benvenisti, a Paduan physician, of much ability and culture, and known for his numerous writings. In a work published in 1870, entitled *The Present and Prehistoric Human Races studied especially from the Side of Anomalies of the Vascular System*, he begins by pointing out the necessity of forming the basis of scientific anthropology on the comparison of the organs and nutritive humours which are found in the different races ; the necessity of filling up the lacunæ in anthropology complained of by physicians. Making comparisons between the representatives of the various races, he reveals many important particulars for pathology, and implicitly shows the conviction that the phylogenetic phenomena give rise to the morbid manifestation. Having described anatomical and physiological facts relative to the lower races, he confesses that the impression left by them is that of having to do with patients of psychopathy originally more or less extensive and profound. These ideas are worthy of being recorded here also for history, because one sees that, in spite of theoretical distractions which certainly must have impeded work more profitable to this author, his mind, in the midst of the documents of natural history, knew instinctively the true method of modern medicine.

1. *The Bony System.*

We shall begin by considering the organization of the bony system.

The internal skeleton, as is known, begins to make its appearance in the *Cœlenterata* (zoophytes) ; but in these it is very far from possessing the morphological appearances it has in man, inasmuch as it consists simply of solid needles included in the mesoderm.

Nevertheless from this rudimentary skeleton we can obtain a useful definition, which is as follows : *The skeleton is constituted of lime salts placed in the midst of organic substance.* We do not mention the discs of silica which are also met with, because they represent only a variety of the species (silicious sponges), and consequently silica is not observed as a normal component in the bones of the higher animals.[1]

In Worms the *cartilages* appear as the organs of support, and are also met with in the *Gasteropoda, Cephalopoda,* and the *Sepia* among the *Mollusca.*

In the *Vertebrata* the internal skeleton has special morphological importance, for while it offers points of contact with that of some *Invertebrata,* it offers us a continuous series of very varied forms through all the divisions of the *Vertebrata* (Gegenbauer).

In reality the skeleton in the embryo of the *Vertebrata* appears as a cord which runs along the whole length of the body, constituted of indifferent cells, and is called the *chorda dorsalis,* or *notochord.* This form of skeleton is special to the *Tunicata.*

But in the embryo of the Vertebrata this simple thin skeleton is met with in the first stage of development only, because it differentiates itself successively. And this differentiation takes place not only in the notochord, but also in the connective tissue that surrounds it (skeletogenous tissue).

The differentiation occurs as follows : The cells of the notochord form a tissue analogous to cartilage, and the cartilaginous productions have a segmented disposition (production of metamera).

By reason of the intimate structure of this rudimentary skeleton embryologists have distinguished three stages of the notochord—

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[1] The salts of bone consist chiefly of calcium phosphate and a small quantity of calcium carbonate. In bone one also finds fluorin, magnesium, and traces of chlorine. But these latter substances do not enter really into the composition of bone salts (*Liebermann Grandzüghe der Chemie d. Menschen,* Stuttgart, 1880).

namely, the membraneous, cartilaginous, and osseous, which is the last to follow. The membraneous stage represents the dorsal cord of the *Tunicata*, and is permanent in the *Amphioxus*, which is the first member of the series of Vertebrata.

The membraneous stage is also met with in animals higher than the preceding—in the lower *Gnatostomes* (Selachii), in whom it constitutes a definite condition of the skeleton ; while the cartilaginous stage, which is repeated in all the lower animals, is transitory, and is followed by the osseous stage.

The transformation of the membraneous cord into cartilage in the human embryo begins at the commencement of the second month, and the ossification at the end of the second month.[1]

The ribs also present themselves at first as membraneous prolongations. Their transformation into cartilage takes place in the second month, as for the vertebræ.[2]

In the animal series, cervical vertebræ with appendages of transverse apophyses situated inferiorly are not rarely found. Very many species of birds have these skeletal peculiarities, which are called *costiform apophyses*, or *pleurapophyses* of the cervical vertebræ. Well, the analogy between these cervical costiform processes of birds with what is found in the human skeleton is evident. The styliform process in birds remains free, in man it articulates with the subjacent vertebra, where it constitutes what is called sacralization, but in man it may also represent a true cervical rib. I have observed and described a very interesting case in 1867 in the *Giornale di Anatomia e Fisiologia patologica* (vol. iv., fas. v.). The costiform process descended from the fifth cervical vertebra, and reached about the middle of the right clavicle. I shall have occasion to return to this finding in the course of this book.

The ossification of the sternum begins much later, and it is only in the fourth year of extra-uterine life that the parts which compose it are solidly united.[3]

All the bones of the extremities are also at first constituted of a soft substance, which as the bones grow is substituted by the stage of chondrification, and finally by that of ossification. To this law there are no exceptions, not even the clavicle, which, contrary to what Bruch maintains, is preceded by cartilage, and, according to Gegenbauer and Kölliker, in man very quickly ossifies in the seventh week.[1]

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[1] Kölliker, *Embryologie*, trad. par Scheider sur la 2^{me} édition allemande, pp. 418 and 420; Paris, 1882.

[2] *Idem*, p. 425.

[3] *Idem*, p. 426.

The most definite notions which we have, still according to Kölliker, concerning ossification of the different parts of the bones of the extremities, are as follows :

1. In the long bones with epiphysis at either end, one of the epiphyseal points precedes the other in ossification. The diaphysis continues for a long time to grow in length from the part which corresponds to the end.
2. In the long bones of smaller proportions having only one epiphysis, the diaphysis grows from it.
3. All the epiphyses grow principally from the articular end.
4. All the epiphyses and all the borders furnished with cartilage have a very active growth.
5. The short bones grow in a uniform manner at all the points provided with cartilage.
6. All the bones of the extremities reach their definite development by the regular and simultaneous action of the phenomena of nutrition and growth of the cartilages.

These generalities on the development of the bones which compose the human skeleton, present three important points —namely :

1. That during *ontogenetic* evolution they pass through *phylogenetic* stages.
2. That the morphological characters of these, even in the early days of extra-uterine life, precede the complete ossification of the parts.
3. That where one sees the stage of chondrification develop abnormally either in time or place, it means that a phylogenetic character predominates, and as such constitutes either a morbidity or a disease, according to the cases.

It is a morbidity so long as this defect of organization remains uncorrected ; a disease when, before it has been corrected, the necessary effects of form and function manifest themselves.

If in extra-uterine life the regular succession of the stages of bony development do not take place, or owing to persistent phylogenetic causes there be disproportion in the development of the parts, the skeleton will present irregularities, disproportions, or, either as a whole or in its parts, will exhibit attributes appertaining to different races, or will show promiscuously characters of both sexes.

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[1] Kölliker, *loc. cit.*, p 509

What is the intimate condition of bone when, as I have said, the morbidity is determined by error of ontogenetic evolution ?

This is indicated by the foregoing facts—that is, there is dis proportion between the animal and earthy matters. Those predominate, and on the epiphyseal ends the vascular and cellular besides the cartilaginous elements abound.[1] And the difference between cartilage and bone, as regards the quantity of calcium carbonate, is readily seen from the following figures : Cartilage, 0·62 per cent. ; bone, 5·44 to 5·50 per cent. (Libermann, pp. 214, 215).

These facts enable us to interpret some pathological phenomena, starting from the principle that *the quantity of earthy matter in bones is in direct relation with their evolution, and the quantity of organic matter is in inverse relation to their evolution.*

We shall now proceed to the pathological applications.

The skeleton of the new-born infant, for the above reasons, offers a special morbidity which may subsequently disappear if the process of ossification have progressed normally ; or it may persist, and therefore give rise to characters decidedly morbid when the work of organization of the elements continues to be performed according to the embryonic type, instead of being modified, as is necessary for the growth and successive ossification, according to the principle of evolution.

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[1] In proportion as the bones approach their complete development, according to Sapey, the animal matter diminishes and the earthy increases. Of the mineral elements the calcareous are considered especially, and they increase in proportion to the evolution (Milne Edwards). In the bones of the frog the calcium carbonate exists in the proportion of 2·45 ; in fishes, of 5·3 ; in fowls, of 10·4 ; in sheep, of 19·3. In man it is found in the proportion of 62·15. A. Milne Edwards has found that the skeleton of woman, in respect to the total weight of the body, is lighter than that of man. Bibra and A. Milne Edwards found that the calcium carbonate increases with age. And Fremy has given the following proportions in respect to age : 2·5 in the new-born infant ; 7·7 in a woman of twenty-two ; 10·2 in a man of forty years. It has been said that among the bones the femur offers a weight which can serve to institute a term correlative with the weight of the brain. This is due to the femora being richer in earthy matter ; for they represent in the higher mammifers, and especially in man, the parts of the skeleton most advanced in evolution, and this naturally is in relation with increase of function. In fact, in the animals which make use of, above all, the fore-limbs, the humerus has a larger proportion of organic matter (Bibra). In the domestic birds, which do not make use of the humerus, these proportions diminish (A. Milne Edwards).

And, on the other hand, the growth and ossification of the bones may take place in such a mode that a skeleton results which in form and proportions does not correspond in every way to the type of the race.

These two propositions make us naturally think of rickets first, and then of all those anomalies of the skeleton which to-day anthropology searches for with such care, and which serve as an argument for illustrating the doctrine of evolution.

With regard to rickets it is necessary to confess that, of all the pathogenetic theories, that of Strellzoff best agrees with the modern naturalistic views. According to this author, rickets is the product of aberration of the type of normal ossification owing to skeletal malformation.[1]

It would not have been out of place to have spoken here of the evolution of the skeleton, considered in its form and comparatively in monkeys and man. But my main object is to confine myself to the things which are more directly useful for the pathological conception which I desire to develop on the guide of the principle of evolution. When in the applicatory part I shall deal with the concrete notion concerning the different particulars, these, both as regards the skeletal and other systems, will be recalled.

2. *The Vascular System.*

The simplest expression of the circulatory system is met with in those lower organisms in whom the nutritive material diffuses itself from the digestive cavity into the protoplasm of the body.

In them the blood consists of plasma, in which float amœboid white corpuscles, which are the most simple form of organisms living independently. And the rudimentary form of the circulatory apparatus is called the *gastro-cavitary*, because the cavity which serves for digestion serves likewise as a circulatory organ, as is seen in the Rhizopoda, and especially in the ciliated Infusoria.

This primitive form is succeeded by the *gastro-vascular*, which is observed in the Sponges, in whom the gastric cavity communicates with others in which digestion takes place, so that the water containing the alimentary substances in suspension enters into the interstices of the tissues, and there deposits these substances which are elaborated by the cells lining the cavities. This form of circulatory apparatus is special to the Cœlenterata in general.

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[1] Strellzoff, *Üb. d. Histogenese d. Knochen*, cited by Pommer (*Untersuchungen üb. Osteomalacie und Rachitis*, p. 407, Leipzig, 1885.)

The circulation of the fluids in the body of the animal is effected by the movements of the animal itself. The blood-spaces are not provided with walls proper. An example of this elementary circulation is met with also in the higher animals, and is known by the name of " lymphatic lacunar circulation."

Another kind of circulation, called *gastro-entero-somatic*, is found in some worms in whom the digestive tube is ramified like a tree.

We have also the circulation with *interrupted vascular organs* in which one sees the central vessels developed in such a manner that they perform the office of a heart. The vessels are distinguished into arterial and venous. They are called " interrupted vessels," because there are lacunæ between the veins and arteries, as in the Mollusca and Insects.

Next comes the *continuous vascular system*, which is either simple or complicated. It is simple when the arteries communicate directly with the veins ; and in the arteries are central contractile dilatations which function like a heart, as in the Annelida. It is complicated when, besides a heart, arteries, and veins, there also exist a very fine capillary system which unites the arteries and veins, and a lymphatic system which is the intermediary between the organs and the circulatory system, and can be considered as the lacunar system of the lower animals.

This type of circulation is met with from the fishes up to man. However, it is necessary to mention that in man all the different forms of circulation which exist in the natural history of organization are found united into a single system.[1]

Starting from a general point of view, we can now formulate a conception which is important for us—namely, that the lymphatic lacunar circulation expresses an elementary degree of evolution of the circulatory system; and that when it is met with in man it may constitute or constitutes a factor of morbidity, considered in the amount of development and in the biological capacity of its elements. Indeed, modern biological observations have proved that the lymphoid elements have very great importance in the phenomena of growth. They predominate in the new-born babe and in infancy: in relation with the other tissues they diminish in proportion to the differentiation of these. Therefore the morbidity will be in proportion to the degree reached in the organization by the tissue constituting the lymphatic circulation—in proportion to the due performance of the functions of the *oxidases*, and their distribution in the different parts of the body (Portier, Soc. d. Biologie, April, 1898).

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[1] In my opinion, Mery and Stendert had a happy idea, comparing the heart presenting congenital alterations described by them to analogous hearts met with in the zoological series. The former compared it to that of the tortoise, the latter to that of the Amphibia. Meckel, above all, tried to discover analogies between congenital alterations of the heart and the normal state of the heart of animals inferior to man (*Handb. d. pathologis. Anatm. B. I.*, Leipzig, 1812). Taruffi (*Congenital Diseases and Anomalies of the Heart*, Bologna, 1875) says that a complete and exact resemblance does not exist between the heart congenitally altered and the normal heart of the animal to which it is compared. But to expect complete and exact resemblance does not appear reasonable, if one consider the phenomena of anatomical correlation which establish themselves between the heart and vascular system of the animal in whom the development goes beyond the ontogenetic stage in which that given phylogenetic note is determined.

From this conception, which will have further explication later on, another of equal importance is derived—namely, that the anatomical knowledge by itself alone is not sufficient to enable us to understand the pathological fact, inasmuch as exact morphological knowledge of the elements, which is complex knowledge that includes form and function together, is necessary. Clinically speaking, following such conceptions one is obliged to infer that many manifestations called morbid are the expression of the function of those anatomical elements taken into consideration, or, in other words, that certain diseases which manifest themselves during individual development, and have a lymphatic character, depend upon irregular evolution of the tissues, in whose lymphatic elements a phylogenetic character is determined more or less durably and intensely.

When one speaks of lymphatic constitution, of lymphatism, it is necessary to recall the morphological conception of the circulation in those definite tissues, organs, or apparatus, in which, owing to causes inherent in the evolution, the low circulatory element is produced excessively, or to causes inherent to the adaptation is produced in abnormal quantities and qualities.

Another important conception derived from the morphological ideas already described regarding the circulatory system, is what we must have of all the intestinal connective-tissue expansions to the organs uniting themselves with the serosæ, and enveloping vessels and nerves.

We have seen the circulatory morphological type which the Vertebrata in general possess. In the two goups of the Vertebrata—Acraniota and Craniota—there are notable differences as regards the heart. The former group does not possess a heart proper, but all the principal vessels are contractile, and still resemble the disposition met with in Worms. The latter group possesses a heart.

The presence of this organ, however, does not exclude the contractile function of the vessels, which from being the principal function has become an accessory one. But it remains as the expression of a definite period of the history of organization ; it remains as a function. Therefore, when we have to consider the physiological and pathological conditions inherent in the circulation, we shall constantly bear this factor in mind.

If the doctrine of evolution had been taken into consideration before now, the contractile property of the vessels would not have been admitted by some and denied by others, but must have been admitted as a necessary fact by all. And if this theory were duly applied to-day, it would give a better explanation of not a few circulatory phenomena, and would show that the contractility of the vessels contributes to the genesis of some morbid states.

One can never repeat too often the fact that the human body is the epilogue of the history of organization, in which all the facts, episodes, and laws of organization are met with, in which variations are constantly and necessarily declaring themselves, in which, therefore, one can see, under the appearance of variations of type or of anomaly, manifestations more or less markedly *phylogenetic* and *atavic.*

We now come to the heart. The heart of all the Craniota at a certain stage of embryonic development is nothing but a tube, an utricle. This as it elongates becomes curved on itself like the letter S.

As the form of the utricle changes, the cavity, originally single, is subdivided into two : one posterior, the *auricle*, which receives the blood and pumps it into the anterior, the *ventricle*, from which it is propelled through the vascular arches into the aorta that runs along the axis of the body to which it is distributed.

From its first appearance the heart is found in the cavity of the pericardium ; the wall of this cavity is the pericardium itself.

The auricle has as a rule two depressions, one on each side, which form the two appendages.

At this point of development of the heart we find the heart of fishes, and also that of the human embryo of fifteen to eighteen days (Coste, quoted by Kölliker).

From this stage of development the walls of the heart have a structure which corresponds to the function: the auricle is provided with a single muscular layer, while the ventricle is furnished with an abundant muscular network. One may better express the condition of things saying that by virtue of the different function of the two parts of the heart they are differently organized. In reality the work of the auricle, which has to pump the blood only into the underlying ventricle, is quite different from that of the ventricle, that has to pump it into the aorta. It is advisable to accustom ourselves to consider matters according to the biological law which proclaims that function creates the organ. It frequently happens that it is necessary to remember this law also in pathology.

At the auriculo-ventricular openings are found two membraneous valves capable of preventing deflux of the blood.

At the arterial orifice of the ventricle are three pocket-shaped valves whose office we know.

The cavity of the ventricle is continuous with the aorta, which at its origin presents a dilatation that constitutes the bulbus arteriosus.

Up to now, therefore, we have the mono-ventricular heart of fishes.

With the progress of evolution of animals, we see the branchial respiration succeeded by the pulmonary respiration, and this determines, according to Gegenbauer, notable changes in the circulatory conditions and in the structure of the heart.

In fact, from the walls of the auricle a network of muscular trabeculæ begins to project and form a kind of septum, by means of which the chamber is subdivided into two—right and left—which communicate with one another in different points, and open into the ventricle through a common opening. The sinus venosus opens into the right auricle, while a pulmonary vein opens into the left.

This condition of things is met with in a branch of the primitive fishes (Selachii), which, according to Haeckel, seem to have been the first animals that attempted to habituate themselves to terrestrial life and to atmospheric respiration.[1]

With regard to the principal phylogenetic periods of the human heart, Haeckel has established that, when the auricle is subdivided into two chambers (appendages) communicating with each other in various points, the heart of the human embryo represents that of the Selachii just mentioned, by him called *Dipnia*, or animals with double respiration ; and that when the interauricular septum is complete it represents the heart of the Amphibians.[2]

Here it is necessary to remember that among the congenital alterations of the human heart we have those which represent precisely that particular structure in the auricular portion which is attributed to defect of development, and which, phylogenetically speaking, represents to us an atavic fact to which, as is natural, other facts unite themselves, as is shown by the clinical phenomena of those who are subject to the above-mentioned congenital alterations. Therefore one can say that in this resides the principle maintained by us—namely, that everything which expresses an anomaly in the process of evolution is the foundation of morbidity.

In Amphibia, then, the septum of the auricle is complete. However, in some animals, such as the Proteus and Salamander, it still remains incomplete (Gegenbauer). The ventricle is simple, but shows rudiments of the future septum.

In Reptiles the organization of the heart takes a step forward ; the ventricular septum makes its appearance owing to the greater development of the muscular trabeculæ. The right half of the ventricle receives venous blood, the left arterial blood. According to Gegenbauer, the imperfection of the interventricular septum is compensated besides by the existence of a muscular prominence, which separates in part the space that gives origin to the pulmonary artery from the rest of the ventricle.

In the seventh period of development of the human heart it resembles, according to Haeckel, the heart of the Protamnia (tortoises, crocodiles). And pathological anatomy has collected a large number of congenital alterations of the human heart in which one sees an architecture which reproduces that of the heart of reptiles, tortoises, saurians, and crocodiles.

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[1] During the long geological period called "archozoic" every living being was aquatic (Haeckel).

[2] In this connection I have pleasure in citing the very authoritative testimony of O. Hertwig. He says : "The embryonic heart of man and that of mammifers resemble the heart of the lower Vertebrata, the Fishes ; in both the heart and the type of circulation correspond. But as in the animal kingdom, so in the embryonic life of man, a change takes place with the appearance of the lungs, because with these the heart becomes duplicated, and the distinction of the greater and lesser circulation established. (See *Lehrb. d. Entwickelungsgeschich. d. Mensch. u. d. Wierbelthier*, Jena, 1888).

In the heart of Birds the separation of the venous from the arterial blood is fully completed.

In the heart of Mammifers the perfect separation of both bloods is also observed. Nevertheless other important anatomical conditions can be registered.

During the embryonic state of the Mammifers the opening between the two auricles, or the *foramen ovale*, persists, for it is not closed till after birth. This foramen remains permanently in the Marsupials, and the pathologist meets with it exceptionally in man.

We shall next take into consideration the auriculo-ventricular valves. They are simple membraneous duplicatures in Fishes, Amphibians, and Reptiles. But with the progress of development of the musculature of the ventricles in Mammifers, a part of them is inserted at the auriculo-ventricular orifice, and is connected with valvular membranes. This condition of things, which is transitory in Mammifers, persists in the right ventricle of the Monotremes.

In all the other Mammifers the muscular trabeculæ retract towards the ventricle, and are substituted by the chordæ tendineæ.

Kölliker, who has verified this condition of things, says that it is not surprising if these chordæ tendineæ sometimes contain muscle fibrils, as has been met with by Oehl, and which must be considered as an important anatomical disposition for the cardiac function; especially if we consider that the amount of these fibrils varies in different individuals, and consequently must impart to the heart a functional capacity variable both in its physiological and pathological states.

In recording these morphological circumstances of the heart, one cannot but think of the error into which all fall while making the physiological and pathological examination of this organ.

They proceed to the examination with theoretical views regarding the heart; they admit that it is what it must be in size, form, and function, according to a very conventional idea, and get such results as are founded upon the data of the anatomical and physiological averages.

If, on the contrary, one think that the embryonic development of the heart in a relatively short time passes through stages which represent, so to speak, the stages of the process of phylogenetic evolution; that the parts of which it is finally composed are formed successively ; that each of them may present some variation in form or size, that consequently the effect of the functional correlation is very changeable—if one think of all this, one can justly conclude that an examination of the heart must take quite another direction than what it has taken up to now, and must have a very different scope than that which consists in the simple verification of the transverse and vertical diameters, the existence of tones and murmurs.

Although in the embryo of all the Vertebrata the principal organs are delineated before the circulatory system appears, still, when this begins to function, it acquires capital importance ; for on the amount of development of the individual parts and of the whole embryo depend the development, and therefore the function, of all the other viscera, as I have said elsewhere. And, on the other hand, by virtue of the law of adaptation, the circulatory system, considered in its most important parts, must offer to the physician a conception which refers not only to the healthy or diseased state of the heart and vessels, but also to its condition of morphological development as a whole or in its individual parts.

If the examination of the heart of the human embryo present to us some anomalous but transitory condition according to the laws of phylogenetic development, the disappearance of that anomalous condition (it not having been established that it has taken place necessarily as quickly as possible or later on) will have as a result that, owing to functional correlation and adaptation, the heart presents a morphological variation to which other conditions inherent in the individual will be subordinate. It is essential to recognize these conditions, because they constitute elements of morbidity. Pathology, as we shall see, provides us with the clearest demonstration of what I have just asserted.

In the anterior superior and internal part of the right ventricle of the human heart is situated a conical projection—the *conus* *arteriosus*—from which the pulmonary artery arises. It gives passage to the blood which is propelled by the ventricle into the pulmonary artery.

Well, the conus arteriosus in man may present abnormally a partial constriction at its base, due to increased muscular development. This constriction is formed in such a way that the conus arteriosus acquires the appearance of an infundibulum, a third ventricle. This condition of things represents the heart of the tortoise and of the higher Reptiles, in whom there are three ventricles—namely, one on the right and one on the left for the two aortæ, and a third in communication with the right for the pulmonary artery.

By reason of this I deny that in man the development of both halves of the heart takes place in a more or less uniform manner. My experience, which I can now consider long experience, has taught me that the human heart presents variations of form which can be attributed only to the different mode of embryonic development and to the successive adaptation of the organ.

Many times while making the morphological examination of the heart declared by others anatomically normal, I have verified considerable differences between the right and left ventricular cavities, to which other differences in the auricles corresponded.

On considering carefully these hearts, one sees more or less distinctly that condition by which the right ventricle, with its capacity greater than that of the left, with the columnæ carneæ more developed than those of the left, with traces more or less evident of the base of the conus arteriosus, indicates clearly that the state of the circulation in the dominion of the pulmonary artery and of the vena cava is very different from that of the aorta. In reality, the left ventricle rather contracted, the calibre of the aorta smaller than normal, that of the pulmonary artery larger—all are morphological criteria which speak in favour of the opinion that the heart does not always represent the normal type; that in the concrete case the blood-mass is not equally distributed in the circulatory tree, but is relatively scarce in the arterial system, and therefore in exuberant proportion in the pulmonary artery and in the system of the cavæ, with all the consequences which necessarily follow in the development and function of the organs and tissues which directly feel such circulatory conditions.[1]

These facts, which I have very many times observed and clinically estimated, have led me to study a clinical method for judging conveniently the heart in healthy and in diseased individuals, as we shall see when I deal with the cardiac index or the morphological examination of the heart.

From the above facts it results that in man the heart may present variations of form which are explained by arguments obtained from comparative anatomy—variations of form to which are united a corresponding functional capacity, and consequently a corresponding variation of development in the whole circulatory system, as we have several times mentioned.

As an inference from what proceeds we can therefore admit that, *conformably with the primitive organization of the circulatory system and its special adaptation in the body, particular physiological attitudes will manifest themselves in this, which can be considered according to the cases as factors of special morbidity.*

Further, if we remember that what is called error or variation of primitive organization represents effectively a defect of evolution of the body, we shall confirm once more that which we asserted when we expounded the general principles of morphology—namely, that all what in the organism indicates an error of evolution may be an element of morbidity.

If an organism have a small heart, if the left ventricle be relatively smaller, if the aortic system be little developed, if the venous system be more suitably developed, if partial provinces of the circulatory system be more or less developed in respect to the others, it means that the organism as a whole presents special morphological characters and physiological attributes which have considerable interest for the pathologist, and which consequently should be recognized and valued justly in every clinical study.

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[1] The fœtal heart is differentiated from the adult heart as follows : in that the circulation of the descending aorta is maintained mostly by the pulmonary artery through the ductus arteriosus. Well, this alone gives us an idea of how it happens that in some cases, even during extra-uterine life, is maintained a greater development of the right ventricle and of the pulmonary artery in respect to that of the left ventricle and of the aorta, recording all the variations which are verified concerning the greater development of the ductus arteriosus. On the other hand, it is known that when the foramen ovale is closed early the aorta remains constricted ; for the size and persistence of the foramen ovale are conditions which establish the relations of the larger supply of blood that from the right auricle flows into the left and into the left ventricle, and of the greater development of the parts.

It is by fixing well one's attention on the evolution of the circulatory system that one can understand clearly and fully some important facts of the organization which later on generate corresponding physio-pathological consequences.

On the one hand, one understands the anatomical relations which exist between the blood circulatory system and the lymphatic circulation; one understands that one can never speak of circulatory alterations without indicating their natural effects in the bloodvessels as well as in the lymphatics and in their lucunar expansions—that is, in the interstitial connective tissue of the organs. One understands, on the other hand, that during development these organs must acquire special characters according to the morphological relations of the vascular system proper that is established in them. One understands that in every organ, besides the characteristic anatomical elements—for example, the hepatic cell, the blood and excretory elements in the liver—it is necessary to take into consideration the amount of development of the vascular system proper as arteries, vena porta, and lymphatics, because on all this depend the functions of the organ, its nutrition, which has so many relations with the interstitial elements, substratum, and different morbid processes. Thus, having admitted that the morbidity of the organ depends upon the specific element and its circulatory system proper, when the relations between the parts constituting it have not had regular morphological evolution, one understands *the necessity of a method of clinical investigation corresponding to the morphological conception.*

If to all this we add that the particular environment of the organ is constituted of material exchange, owing to which the nutrition and function of the organ take place in it, we will likewise understand that to the morphological condition corresponds a chemical condition which now more than ever is sought for to explain the morphological facts, it being not only one of the most subtle, but also one of the most active, factors of morbid dispositions.

Later on, when I deal especially with the application of these conceptions to clinical pathology, we shall have their demonstration and confirmation at every step.

3. *The Nervous System.*

Although the numerous and important researches on the venous system directed to illustrate physiology and psychiatry have shed much light on the problem of the organization of man, and on his habits, his more elevated capacity and multiform degradations, and have thus fully confirmed the axiom that the cause of the special morbidity of the organism resides in its special morphology, still, it is not in the order of these facts that I must search for the indications useful for my demonstration.

The physiologist and the alienist, who in the abnormal evolution of the nerve centres recognize the cause of functional anomalies, therefore of irremovable tendencies and instincts, can find very important facts by examining the development of the nervous system from the amphioxus up to man.[1]

But the clinician who is desirous of knowing in what consists the special morphological condition of the nervous system which favours some processes of altered nutrition manifested by the nervous system of individuals having either normal functional characters or indications more or less evident of abnormal evolution must not confine his examination to the form of the organ, to the knowledge of the normal and abnormal relations existing between the constituent parts, but must also consider the nervous elements and those others by which they are accompanied and with which they are in intimate relation, because indispensable to their conservation.[2]

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[1] While correcting the proofs of these pages I came across, in the *Rivista di filosofia scientifica* (vol. ix., second series, July, 1890), an interesting article by Dr. E. Tanzi (physician to the Psychiatric Institute of Genoa), entitled *Folk-Lore in Mental Pathology*, which I read eagerly, because it was inspired by the principle which I have mentioned in the text, and because it aims at referring some forms of mental alienation, such as delirium of persecution, delirium of poisoning, religious mania, delirium of ambition, erotic, hypochondriacal and other forms of delirium, to lesions having their root in the history of the evolution of the human mind or of human thought. We can very well apply to mental pathology also our principle—namely, that a special morbidity exists in every individual who manifests an anomaly in the evolution of his cerebral organ. At the same time, I am delighted to see such an important scientific conception developed by him whom, owing to his ability, I included among my most promising students.

[2] Gratiolet maintained that, besides the weight and especially the form, one must take into consideration the power which exists in the brain, and which can be measured by its manifestations alone. Without sharing the philosophical principles of the author, I can endorse this opinion, and justify it by the results of experience, admitting that a certain relation exists between the development of the intelligence and the size and weight of the brain, but that at the same

Therefore we shall have to know, not how the evolution has been effected in the whole nervous system, but how that of the primitive elements has been effected, how the nervous system from its simplest physiological expression, from its indistinct state, such as it is in the hydroid polype, for instance, passes to its primitive distinct morphological expressions when the aggregates of the nerve cells and fibres make their appearance. It is in this period of evolution, when the elements begin to form the nervous ganglion and cord, that the histological association assumes a distinct character, and both the ganglion cells and the nerve fibres are subjected to the action of the environment, readily declaring itself differently according to the special organization.

As is seen, the acquisition of this knowledge, which must help us to know the special morbid disposition to definite diseases, belongs to the future. Up to now studies have been directed on the development of the complexive form of the nerve centres, not on the mode of organization of the specific and accessory elements which compose them. Besides, in the same way that in the complexive form considered we see examples of reversion, thus in the intimate histological constitution an analogous fact is to be looked for, because first of all the form and mass of an organ are connected with the quantity of the elements which constitute it, and the function depends upon the quality of these elements ; in the second place, daily experience convinces us that the nervous system, like the bony and every other system, must obtain from its primitive evolution better or worse attributes for its final development, and the certainty of its nutritive and functional processes.

I have consulted books of comparative anatomy and of embryology with the object of finding information on subjects of which I had little knowledge, but I have obtained little or nothing from them. Hence it will be admitted that the embryonic connective - tissue substance which surrounds and penetrates between the bundles of peripheral nerve fibres undergoing development should be an object of special study ; that the

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time there exists an unknown which ennobles the mind of a Dante, for example, and renders common that of another individual whose brain is equally voluminous and heavy. This unknown is not the power in Gratiolet's sense, but the special organization.

neuroglia of the nerve centres and the development of the vessels also deserve study, for the importance of these elements during embryological development and in pathology is well known.

It is necessary to be able to know if the anatomical constitution of the nerves in man, considered in the elements which form their environment, can offer variations ; if these correspond to analogous phenomena of comparative anatomy ; and if special physiological activities and morbidities correspond to the different kinds of anatomical constitutions.[1]

If one thinks of the different nervous susceptibilities which are observed in individuals, of the differences which are seen in the mode of reacting of the nervous system as a whole or in its parts, of the inflammatory or degenerative processes which are set up by even slight causes in some persons, and are not set up by more intense causes in others, one will feel the necessity of other ideas besides those of the customary causes.

The great influence of heredity will doubtless be suggested, but this, instead of explaining the unknown things, only expresses them differently ; while with this expression one indicates precisely what I have already declared as to the necessity of new studies on the morphology of the nervous system in general.

There are forms of neurosis which last for years and years, till at a certain period they become modified by the appearance of phenomena which enable us to diagnosticate slow and progressive processes of trophic alteration of the nerve centres. Well, the history of these cases shows us once more the importance of the new studies which remain to be done, because we can say that inheritance began to manifest itself with the primary neurotic form, but that in the final symptomatology the result is declared of the original morphological anomaly by which the neurosis was maintained.

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[1] Dr. L. Frigerio, Director of the Provincial Lunatic Asylum, Alessandria, read an interesting communication at the Third Phreniatric Congress, held at Reggio Emilia in September, 1880, in which he said : "Starting from the principle according to which 'the special morbidity of the organs from their special morphology is derived,' lately announced by Professor De Giovanni, the chief scope of my work was to establish in what measure the frequency and importance of the anomalies of the cerebral circulatory system in the mentally deranged, in relation with mental alienation, and in comparison with individuals sound in mind, was verified post-mortem. Among thirty-seven autopsies, twenty-one offered important anomalies of vascular disposition or of development ; from the thinness or imperviousness of the posterior communicating arteries to the more evident transposition of origin and of course between the posterior cerebral arteries and the posterior communicating arteries ; from the absence of an arterial trunk (substituted by capillary network) and the scarcity of development of the nutrient arterioles to the free expansion of these in the overlying organs."

I have not been able to institute regular and numerous researches, but whenever I have had the opportunity of comparing homologous parts of two brains, I have always noted differences which up till now have been neglected, while they represent an important anatomico-physiological factor.

Examples are not wanting of persons who from childhood have suffered from some functional nervous defect—a *tic*—and which after a number of years becomes associated with certain phenomena that later on manifest with it symptomatic relations special to a definite malady of the nerve centres.

We must mention another circumstance—namely, that which concerns the amount of the bloodvessels in the centres of innervation. Here one has to deal not only with anomalies of form and of distribution of the vessels, but also and especially with the quantity of blood which goes to and comes from the nerve mass, with the regular or irregular distribution of the capillary circulation. And the study of these particulars, the importance of which is too evident for me to dwell upon, must also be made under the guidance of comparative anatomy and embryology.

It is essential to continue the morphological and physiological researches on the body to find the true indications of the individuality in the whole nervous system. For the moment, regarding this grave argument, we can affirm nothing definite which would help to clear up our thesis ; we have nothing but presumptions.

Nevertheless, we can profit by a maxim dictated by modern morphology and sanctioned by experience—it is that *function creates the organ.* From this I obtain another as a natural consequence—namely, that *function reveals the anatomical conditions of the organ.* This, I believe, is the rational basis of every diagnostic research, and one wishes to extend its application, which, however, is not a new thing in the history of our science, if we remember by what able intuition the luminaries of clinical pathology have succeeded in tracing the first lines of the physiology and pathology of the nervous system, and who to-day, by means of their critical observations, have begun to discuss the most difficult problems concerning this system.

If function reveals the organ, and we interpret its function by the strictly scientific method sanctioned by experience, we may hope to succeed in discovering the criteria according to which the morphological substratum of the nervous system can be suitably judged.

Meanwhile we can start from the more general facts—the degree of excitability and of functional resistance. I believe I do not go beyond the bounds of experience maintaining that excess and defect of excitability and greater or less functional resistance indicate different and, in proportion to the defect or excess, abnormal morphological conditions.

What conception can we form of these special morphological conditions, and therefore of the morbidity which may be derived from them ?

Here it is that we see the necessity of comparative anatomical and physiological investigations on the series of the Vertebrata, including, of course, the different human races, which shall enable us to establish the natural relations between the expressions of the different degrees of excitability and of resistance and the different morphological conditions.

That which I have said of the nervous system in general I shall apply to its various parts to establish which of these can be distinguished, in respect to all, for its greater or less excitability and resistance and fineness of function. This we see happen in every individual, and constitutes the physiological character of the Vertebrata.

A glance at the psychic faculties of animals will strengthen our conviction on the method of study which we have proposed, for we shall see that one can know man by studying the lower animals.

The sense of touch, which in the Infusoria resides in a rudimentary form in the cilia, which, better developed, exists in the tentacles of Polyps, and which reaches a notable degree of development in the higher Mollusca, and then more and more notable as we pass to the Monkeys and Man, is not revealable in the infancy of man and of the monkey. Both after birth, for judging things presented to them, or which they instinctively seize, make use of their lips and tongue. This is what one sees in the Reptiles and Ruminants. Birds also give an example of exquisite sense of touch in their beak.

The Primates of the family *Simiidæ* conserve during life the habits of infancy, and if we watch some idiots in their habitual movements we shall see some of them repeat the simian habits during their whole life.

The infant does not distinguish the part of the body stimulated or irritated ; it cries without making any effort to remove the cause of irritation. This does not apply to the ordinary adult, who even without the guidance of vision can place the hand on the part stimulated. The Carnivora in respect to touch are similar to the infant. The Ruminants, on the contrary, are born with a higher degree of development.

A marvellous example of fineness of touch is offered us by the Bats. The well-known experiments of Spallanzani, Carlisle, and Cuvier demonstrate this so splendidly that there cannot be a shade of doubt.

In Man, as a rule, touch does not reach such fineness ; it does so, however, in some cases of disease met with in hysterical subjects and in the somnambulistic phase of hypnotism.

The sense of taste, the most universally extended in animals, manifests itself very soon after birth, and lasts into old age, even when the other senses are more or less blunted. In general one can say that the sense of taste directs animals in the selection of food ; that the kind of alimentation induces a special adaptation of the organs ; consequently that the organization of each species is in strict relationship with the kind of alimentation.

Man is said to be carnivorous, and it is true. But all are not equally carnivorous nor equally frugivorous. In the human races the taste for salt is not equally diffused, and we know that salt is sought for by the lower animals.

The selection of taste has therefore an expression connected with the individual morphological conditions—that is to say, taste considered in the condition of its normal exercise.

It is unnecessary to extend our researches to all the classes of animals ; it is sufficient to confine ourselves to the consideration of taste in the higher Vertebrata to find among these the manifestations of the sense of taste for one kind or another of alimentation which is habitually preferred by some men, and which in these actually constitutes a variation of taste, and therefore an indication for the corresponding special morphological data.

In this connection daily and universal experience proves the justice of these conceptions, that consequently can be included among those which must direct our study on the individual.

Smell is intimately connected with taste ; we can say that the one completes the other. The sense of smell is not possessed by all animals ; however, some fixed Polyps possess it, and in the Crustacean *Astacus marinus* it is very keen. But it reaches its greatest keenness in the terrestrial animals. It is almost phenomenal in the Insects ; the *Apes mellifica* is directed to a distance of 2 kilometres on the track of the perfume exhaled from flowers.

Smell guides animals to the quest for food, to flight from enemies, to sexual attraction.

While we see this sense so developed in some of the lower animals, it is not equally keen in the human species. Savages are led to the search for food more than all by sight and hearing, and in this they resemble the carnivorous birds rather than the carnivorous quadrupeds. Darwin states that if we place before the condor a piece of meat wrapped up in paper, it does not perceive its favourite food ; but if in the paper there be a small opening, this tiger of the air in a moment becomes ravenous to devour the meat.

The mode of behaviour of the sense of sight and that of smell in the carnivorous Vertebrata is notable. Vision increases when smell diminishes, and *vice versa*, as if the two senses were destined to substitute one another. And this is revealed not only when the species belonging to the same order are compared with one another, but also when the different races of domestic dogs and various individuals of the human species are considered. In man also examples of very delicate smell are met with. Humboldt mentions some Caribbeans who could distinguish whether the last person who had passed along the road was white or black. Houzeau says that the negroes of America knew in the dark individuals of their acquaintance by their odour. The blind Bohemian nun who distinguished persons by their odour will be remembered. Humboldt likewise narrates that the Peruvian Indians during the darkness of night distinguished the different races by their smell, and that they had three words for indicating the odour of the European, native American, and negro ; they are *pezuna*, *posco*, *graio*. The celebrated traveller Livingstone, speaking of the antelopes, says that, while watching a large number as they came towards him, he quickly hid himself in such a way that the wind did not carry his odour in their direction, but in spite of this at a certain distance they became alarmed.

Just as the Carnivora, warned by the odour, fly from man, so also the savage uses his sense of smell to discover the presence of an enemy.

Smell is the guide of terrestrial animals during the pairing season. The Insectivora, Rodents, Pachyderms, Ruminants, Carnivora, are attracted by the odour ; the Quadrumana are not attracted by it alone ; and Man is attracted especially by the sight. Nevertheless, examples are not wanting among men which show that the odour of the opposite sex can excite their sexual desire. And just as some men obtain pleasure from the presence of some odours and disgust from others, so also many animals seem to enjoy themselves in the midst of the odours of some plants, and to fly from the emanations of others.

The hearing of aquatic animals is in intimate relationship with the sense of touch. The sonorous waves determine movements in the molecules of the water which reach the body of the animal almost simultaneously with the sound. However, among these animals there are some who are completely deaf.

Among the terrestrial animals also there are some—namely, the Arachnidas, Crustaceans, and Insects—which are deaf. With regard to delicacy of hearing we have wonderful examples in the lower animals. The nestlings even when immobile in the nest are aware of the approach of the mother-bird before they have seen her. Montagu, who has made experiments in this connection, thinks that the mother-bird announces her coming with a cry which cannot be heard by the human ear.

But we can say that the sense of hearing, contrary to that of touch and of smell, reaches its highest perfection in man. Although there are examples of pleasant impressions determined by sounds in animals, and we see some song-birds which listen almost enchanted to the sound of the human voice and of instrumental harmonies, yet it is man only who has a perfect ear for music and shows the great effect it produces on him.

Man has, in common with some of the lower animals, the sensibility—I would almost say mechanical—for slow and quick rhythm, as is heard in the marching of infantry and cavalry ; the special sensibility for certain sharp and low sounds is also common to man and the dog, for example, of whom the special kind of emotion it feels when excited by music is well known. But man is the sole interpreter and the sole composer of the musical harmonies which may well be called the language of the angels, miracles of poetry, which touch and put in unison all the fibres of the human heart.

Nevertheless, even in man anomalies as regard the sense of hearing are met with. There are some who are deprived of the musical sense, like most of the lower animals, and I believe I can maintain that this is a true character of inferiority.

Neither is vision possessed by all animals. Many Insects, especially among the Coleoptera, are blind, as are certain species of the Vertebrata and some Mammals.

But it is not useful for our purpose to dwell upon similar facts. It will be useful, on the contrary, to examine for a moment the range of vision in animals. This varies not only in the different ages of life, but also in the different species of animals.

In general one can say that the human eye has an immense range, inasmuch as it reaches the stars. But there are men whose sight has a range not greater than that of the dog, which does not exceed 100 metres ; the dog is a myope. Many birds are, on the contrary, presbyopes. The cat possesses nocturnal vision, and there are men who can distinguish objects in the dark. The literature registers some examples, and I remember a priest who, when he consulted me for an affection of the stomach associated with cerebro-spinal neurosis, informed me that whenever he suffered from hemicrania, which lasted not less than twenty-four hours, he saw during the whole night, whether in deep sleep or awake, the furniture and all the other things contained in the room.

Man when compared with the lower animals certainly shows himself superior with regard to the concordant development that all the senses have reached in him, while these are not equally possessed by all the lower animals. But when in man they become remarkable owing to their degree of development, or to the importance they assume determining particular functions, they may be regarded as atavic and pathological phenomena.

The history of neurasthenia is rich with examples of this kind, which fully confirm these ideas.

The function of the senses, and, better still, of sensation in general, is destined to put the organism in relation with the external world, from which it must obtain everything that is useful for the conservation of the individual and of the species. And as we know that the properties of sensation may vary according to circumstances and to the biological scope, thus it happens that anomalies of sensation, of nervous irritability, in man must be considered as functions which do not always contribute indirectly and in the best way to the adaptation of the body, and consequently to the constitution of its individuality.

Among the properties of the lower animals is that property through which the presentiment of meteorological changes has been attributed to them. The exquisite sensibility of some to the slightest changes of weather, like the wonderful sensitiveness of many plants to light, is a phenomena which results from a combination of physical causes—for example, hygrometric variations of the air—but which manifest themselves by the intervention of the nervous system. In all this a biological property of a high order is revealed. Nevertheless, when in man it is met with in an exceptionally exquisite form, it constitutes an anomaly of which we have examples in hysterical and hypochondriacal persons and in the insane, an anomaly which, without giving rise in the individual to truly morbid symptoms, generates vicious tendencies, habits, instincts, which subsequently become united with all the other modes of behaviour of the organism. I believe that all these notions are of special interest to the physiologist and the pathologist, for every habitual manifestation of the nervous system is attended by material facts, in the same way that similar relations exist between the rapidity of succession of mental operations, the rapidity of the circulation and the greater morbidity of the organ, as the effect of the corresponding trophic function.

It is unnecessary to insist further on this question. It is very evident that when we have acquired the habit of making those researches on the individual mentioned above, researches directed to know intimately the nervous function in its phylogenetic expression, in its capacity to determine particular habitudes in the organism or special functional tendencies in certain parts, we shall have added valuable pages to the natural history of man; and shall have acquired a series of scientific criteria indispensable for extending our knowledge concerning morphological individuality, and for understanding all the factors which direct its evolution and adaptation.

When we have succeeded in arranging the facts and documents relative to the comparative pathology of the nervous system, we shall have reached without doubt the end of our work; that is to say, we shall have carried medicine into its new sphere, that of natural history.

For the present, being unable to make use of the scientific material necessary for the study of the morphological individuality in every morbid case, we have to be guided by the indirect criteria obtained from comparative physiological and pathological observations, derived from the maxim, that *function reveals the morphological condition of the organ.*

Keeping to the teachings of experience, we shall see whether the nervous system presents one or other of the properties indicated in the subsequent table for making it the basis of our judgment.

PROPERTIES OF THE NERVOUS SYSTEM.	*Normal* . .	in all the cerebral and spinal parts and the sympathetic system.		
	Erethistic	cerebral sphere . .	mental and affective faculties.	
			sensorial acuteness.	
			motor faculties.	
		Spinal sphere	action of the medulla oblongata.	
			action of the cervical portion.	
			action of the dorsal portion.	
			action of the lumbo-sacral portion.	
		Sphere of the sympathetic	of the head and neck.	
			of the thorax	heart.
				lungs.
			of the abdomen	digestive apparatus.
				uropoietic apparatus.
				genital apparatus.
	Torpid . . .	as for the erethistic.		

In registering the phenomena relative to the anomalies of innervation, one must recall what refers to the *metamera* of the cerebrospinal axis.

NOTE.—For the purpose of scientific study, and for practice when it is possible, one should make the comparison of the peculiarities and anomalies which are met with in the individual, with those peculiarities which appertain to individuals of the other races and of the Vertebrata in general.

4. *The Muscular System.*

From the study of the evolution of the muscular system many useful applications to human pathology cannot be derived. Nevertheless, the facts which we shall briefly describe will help greatly to confirm the reader in the scientific conception followed in this book.

One can say that, knowing the myology of the Primates, one knows in great part the myology of man.

The facial muscles of man, when compared with those of monkeys, have acquired a higher degree of independence, owing to which they can submit themselves to infinite modifications of physiognomic expression. However, both in man and the anthropoids, they have an equal disposition; in the chimpanzee, as in man, the auricular muscles, as compared with those of animals with mobile ears, are equally reduced.

The muscles of the human nucha, by virtue of their having to perform less work for maintaining the equilibruim of the head, have lost the bundles of reinforcement that monkeys possess; but the gorilla and the chimpanzee do not differ in this from man. In the lower monkeys the *splenius capitis*, which is found in all the anthropoids and man, is wanting. The *scalenus medius*, which exists in the whole of the anthropoids, is met with as an anomaly in man (Testut). In the lower monkeys one finds united together the *seratus magnus* and the *levator anguli scapulæ*, which in anthropoids and man are distinct. Neither the gorilla nor the chimpanzee has the *pectoralis tertius* of the lower monkeys, and in them as in man the *pectoralis minor* arises from the ribs and sternum. The *rectus abdominis*, which in the biped position has no need to support the weight of the abdominal viscera, nor to assist in flexion of the fore-limb, loses the aponeurosis which is prolonged to the sternum; and this characteristic approaches anthropoids to man. The *psoas parvus*, which has also lost its utility in the biped position, is reduced to the minimum in anthropoids, and is rudimental, supernumerary, or wanting altogether, in man.

The absence of the tail in man is attended by the disappearance of the elevator muscle of the tail, and in this respect also the anthropoids resemble man.

The accessory muscle of the *latissimus dorsi*, common to monkeys and anthropoids, is only exceptionally present in man. The *palmaris longus* is frequently wanting in the forearm of man ; it is constant, but much reduced, in anthropoids. The *extensor indicis* and the *extensor minimi digiti* are isolated and independent in man, and also in the chimpanzee and gorilla.

Gratiolet and his school wished to draw a hard-and-fast line between man and the monkeys in general because in these the function of the opposition of the thumb does not exist—a function performed, as is known, by the *flexor brevis pollicis* and *flexor longus pollicis*. But in reality in the gibbon as in man there are two deep flexors distinct from each other from their origin. In the gibbon the *flexor longus pollicis*, having reached the hand, sends a part of its tendon to the *flexor indicis*. And this disposition has been frequently met with by Chudzinski.[1] Further, as anomalies in man the same dispositions have been found which are normal for monkeys as regards the belly of the *flexor pollicis* with the belly of the *flexor profundis*, up to the total disappearance of the tendon destined for the thumb.

The development of the glutei muscles, and therefore of the nates, is justly presented as a characteristic of the human body. One understands, moreover, that in this is manifested an adaptation relative to the biped position of man, and to the exercise of the equilibrium of the vertebral column on the pelvis. But it cannot be maintained that all this constitutes a fundamental difference of organic structure.

With regard to the musculature of the lower limbs, in spite of the appearance it presents in man and in anthropoids, there are only slight differences relative to the greater or less expansion of the tendinous and aponeurotic ends. Man is distinguished by the size of the calf due to the *gastrocnemius* and *soleus* muscles ; but even here the difference is more apparent than real, inasmuch as the bellies of these muscles are prolonged almost to the heel. From this point of view the negro would be a connecting link between the gorilla and man.

In man the *plantaris gracilis* is often absent. It is well developed and constant in monkeys, in whom it is frequently inserted in the plantar fascia. In anthropoids, on the contrary, it ends at the os calcis, and shows signs of disappearance.

The *abductor transversus hallucis* of monkeys is found in a rudimentary state in man.

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[1] Chudzinski, *Bullet. de la Soc. d'anthropolgioe*, p. 625, 1881.

The *extensor brevis digitorum* of monkeys presents four muscular portions, which are distributed to the first four toes precisely as happens in man. This is contrary to the opinion of those who maintain that in monkeys there are only three portions, and that in them an *extensor brevis hallucis* exists. If in monkeys the first portion is a little more distinct than the other three, this does not indicate a true differential character, for in man also it has been found completely separated on several occasions (Testut).

In man the *flexor brevis digitorum* is more developed, and arises from the os calcis ; that of monkeys is smaller, and has only two portions. The *perforating tendons* belong to a little muscle united to the *flexor longus*, and has been met with several times in negroes.[1]

I would have much more to say if my object were to describe in a systematic and comparative way the myology of man and of monkeys. I have wished to give only examples which show how well founded the theory of evolution is, and what light can be obtained from it by physiology and pathology.

5. *The Digestive and Nutritive Processes.*

It frequently happens that the physician finds himself confronted by physiological facts relative to nutrition, or by therapeutic facts, including poisoning, which he readily explains, invoking either idiosyncrasy or individuality, but without understanding the only natural reason of the facts observed. Not rarely one finds it almost necessary to institute comparison between facts exceptionally met with in man and those characteristic to one or another of the lower animals. But, notwithstanding this, one does not proceed to the research to which the observed fact invites one, almost avoiding on purpose the seduction of a theory which one distrusts.

I believe, on the contrary, that the knowledge of the process of digestion and of nutrition, as well as that of the receptivity which the lower animals present for substances that man adopts as food and drugs, would be useful to the progress of the science.

It is because every man in his special mode records, so to speak, his phylogenetic origins that in his nutritive processes, receptivity, and tolerance for drugs, he is never perfectly equal to another. For this reason, whenever one has to consider a question of physiological chemistry and pathology for establishing dietetic and curative measures, the preconceptions founded upon chemical rules are exceptionally and partially followed by conclusive results; or if they correspond in one case they may be contradicted in another.

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[1] Chudzinski, *Revue d'anthropologie*, p. 21, 1874, and p. 615, 1884.

As in the structure of the organs, so also in the function of the elements which compose them, man may present particulars that appertain to other beings. It is essential to know all this before one can proceed with full competency to the solution of many interesting questions concerning the physiology and pathology of metabolism.

By this I do not intend to minimize the importance of the researches which have been and are still being made—an importance too high not to be recognized. But I believe that the haste to arrive at a conclusion shown by many and the desire to pass quickly to the practical applications are to be condemned. I believe also that one should not follow the example of some workers, who wish to generalize too extensively the results which they have obtained, especially if they have obtained them by experimenting solely on the lower animals. The biological study of some substances made for the purpose of comparison in the rabbit, rat, dog, or frog, may offer very useful information concerning the mode of action of the given substance, but not the exact knowledge of its therapeutic value, which can be procured by extensive clinical experience alone.

For this reason I would wish that the studies of comparative physiology and therapy were more cultivated, and thus become familiar to physicians.

I shall try to explain myself more fully in the following remarks on the process of digestion and of nutrition considered in the scale of organized beings.

Before the material which surrounds the living thing can enter to make part of it, a preparation is necessary—that is to say, digestion.

We see a digestion even in vegetables, whose roots separate an acid juice which renders soluble the carbonates and other salts insoluble in water.

From the classic researches of De Barry many others have originated which demonstrate the process of digestion in the

Protozoa, and the investigations of Krukenberger, Engelmann, Reinke, Greenwood, Rustizky, and Metchnikoff [1] have established that in some Protozoa the digestion of albuminoid materials takes place either in an acid or in a neutral medium, according to the genus to which the animal appertains. Metchnikoff later took up the study of the intracellular digestion of the phagocytes in the higher animals, and in them has met with facts analogous to those observed in some Protozoa—namely, the ingestion of heliotrope powder by the leucocyte, and the reddening of the granules collected in the nutrient vacuole, where the principal digestive acid is found.

These facts throw some light on others obtained by clinical empiricism, but which have been recorded as useless instead of instructive curiosities—as, for example, the digestion of meat placed under the skin or on an ulcer, the presence of pepsin in the blood and in muscle, the digestion of albuminoid materials which is met with in carnivorous plants.

Knowing that every cellular element possesses the digestive capacity, one understands how much there is to learn concerning the dietary to be employed in every normal and pathological case. But, above all, one understands the great importance of comparative physiology and the necessity of following faithfully its method.

It is known that the faculty of digesting which appertains to the whole of the monocellular individual, owing to the division of work, is not transmitted by all the cells of the complex organism higher in the scale of organized beings, because it is localized more and more in proportion to the higher degree of organization in certain parts of the organism. Notwithstanding this, can there be individual morphological variations, consequently variations of the digestive process? The most ordinary observation proves this by the fact that even in men of the same race, of the same family, the digestive process is not identical in all, and by instinct some select one kind of food and others a different kind. Proceeding from these empirical data to what biological chemistry teaches concerning the importance of lecithin in the nutrition in general of the cells, one can say—in fact, must say—*that the process of digestion in all individuals, without exception, is directed to the preparation of the same nutritive materials, but with a work*

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[1] *Annales de l'Institut Pasteur*, t. 3, p. 24, 1889.

which differentiates itself according to the individual morphological condition.

Who does not see in this the necessity of knowing what phylogenetic note is hidden in these physiological manifestations? Who does not remember having been obliged sometimes to abandon certain general precepts of physiology to follow the guide of instinct?

And the necessity of advancing our science along the lines of natural history becomes more and more urgent when we reflect that many bodies which are, so to speak, the material of the fundamental chemical operations of our organism are also that of the lower organisms, so that the difference which in this connection exists between man and the lower animals is derived up to a certain point from the form that is constituted by the association and function of these bodies, instead of from the diversity of the substance; while the alterations of form of the human organism or of its constituent parts are due to a degradation which the intimate biochemical functions present. Intestinal absorption, for example, depends upon, besides other circumstances that it is unnecessary to mention here, the thickness of the epithelial layer, and the nature itself of the epithelium, regarding which there is everything to learn.

Among the strange facts of the human body is the following fact, of which I have already spoken in another place, but which must be more fully described here—namely, that in the same individual there may be a system of organs which have reached the highest degree of evolution, and another, on the contrary, which has remained at some degrees lower. This inequality we shall frequently see if we consider, for instance, the personality as it appears to us owing to the very high functions of the nervous system on the one hand, and to the production of lymphatic elements here and there predominating, or to the excessive production of fat, or that of uric acid, oxalic acid, etc., on the other.

Sometimes, it is true, in connection with the low evolution of the nervous system, one finds a corresponding degree of evolution of the trophic system. In such case we have individuals whom even ordinary experience recognizes and classifies as inferiors.

But the important thing for us is to know how to recognize that factor of the organization or that given functional phenomenon referable to the trophism, and which will enable us to acquire a truly natural conception of it, independently of the pathological doctrines, having their origin in wholly hypothetical premisses.

The production of fat, which reaches even to polysarcia ; that of uric acid, which extends to the manifest phenomena of gout—all the pathology of metabolism must be, from our point of view, remade, because the true origin of the morbid phenomena must be sought in the part where a definite morphological condition of the human body (be it partial or transitory by reason of individual evolution) reproduces an inferior morphological condition. This being known, the investigation of the phenomenon, or of the complex part proposed for study, will become less difficult for the physiologist and the clinician.

We shall take an example from the production of fat. As is known, in organisms in general there occurs what the biologists call the *organic* or *nutritive* reserve—that is to say, the store in some parts of the body which serves to repair the losses.[1] What we are about to say in this connection will refer especially to the fatty substances. The connective tissue (subcutaneous cellular tissue, mesentery, perivisceral and interstitial cellular tissues) is that in which the fat accumulates. But this accumulation is not so much in proportions corresponding to the introduction of the fatty substances as in proportion to the elaborative function of the digestive organs proper and of the cellular digestive function. This is proved by the congenitally polysarcous and the polysarcous in general, who, one can say, make fat from what they eat, and from whom also was obtained the empirical demonstration of Kühme that the fats can be derived from albumin. This was subsequently confirmed by Pettenkofer and Voit when, experimenting with an absolutely albuminoid diet, they succeeded in producing an excess of fat.

Inasmuch as in the zoological series there are lower animals which store up enormous quantities of fat ; inasmuch as in them the digestive process, which I would call intestinal and cellular, must be different from what, according to the general principles of physiology, is supposed, it is natural to admit that, *when in man an excessive production of fat manifests itself, one must likewise admit a digestive function which resembles that of the lower animals.* Further, as the accumulation of fat becomes not only general in every part of the body where the connective tissue exists, but one also sees partial accumulations which, normal in some animals lower than man, and even in some of the lower human race, constitute true anomalies in the superior race, it is natural to admit that *the connective tissue, having this special assimilative activity for fat, must, from the morphological and physiological points of view, be considered not quite identical with that in which the same is not met with.*[1]

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[1] Animals, like vegetables, transform starch into fat ; and the reserve fat of animals has its analogue in the fecula and the reserve fat of vegetables. The chemical constitution of this fat, which in reality consists of glycerine combined with margarine, stearin, and oleic acid, is not the same in the whole of the zoological series ; for stearin predominates in ruminants, margarine in the hog and man, olein in plants, fishes and birds. Everyone understands the importance of these particulars.

These ideas justify the opinion of Toldt that the fatty connective tissue in the Vertebrata represents a special organ provided with vessels proper, and capable of a particular exchange of material whose product is fat. And one sees also the reason why the organism, as it grows old, or becomes impoverished by loss of blood from venesection, piles, or profound lowering of the nutrition following exhausting diseases, may get fat.

And I say *may* get fat, for this condition is not constant. It occurs when in the individual morphological conditions capable of submitting themselves to the influence of the changed general conditions exist. Therefore, this consideration also confirms the conception that in the excessive production of fat in general one must see an inferior morphological characteristic.

Rickets, scrofula, oxaluria, glycosuria, gout—all the morbid manifestations connected with what Bouchard calls the *oligotrophic* and *bradytrophic* diatheses[2]—are waiting for the science to shed some light on their pathogenesis by means of morphology. As we shall see later, the form of the body indicates by its special notes a particular organization of the individual having the symptoms of this or that infirmity. But it is necessary to go deeper into the process of nutrition to find out the mode in which the food is utilized and the morphological factor to which the anomaly is due that declares itself under the form of disease.

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[1] The copious production of fat is connected not only with the quality of the aliment, but also with a special individual or racial disposition. The Chinese have a remarkable predisposition to grow fat; the Dutch more than the Germans, these more than the French, and the latter more than the Italians. It is known to all that the beauty of the Hottentot Venus is represented by a simian characteristic, and is regarded as a true monstrosity, which in a less pronounced condition is met with also in individuals of our race in whom the curves of the lower part of the trunk exceed the limits of æsthetic harmony.

[2] Bouchard, *Maladies par ralentissement de la nutrition.* Paris, 1882.

With regard to rickets, I have mentioned that its pathogenesis consists in an arrest of development of the bony tissue, or, rather, in an excessive production of the embryonic elements which constitute the normal degree of skeletal evolution for some lower animals. Well, it is sufficient to recall the clinical pathology of rachitism and all the history of rachitis to know that the symptoms of this disease are generally preceded by symptoms of intestinal alteration, of anomalies of digestion, especially in the period in which we know that a step forward in the evolution of the digestive organs takes or ought to take place. Then, indeed, under the form of intestinal catarrh (a term much abused, and which includes many very different conditions), one has indications of an abnormal state of the intestinal environment. The spleen, tumid or not, is the seat of chemical changes on which one would wish to make the skeletal lesion partly depend. But it is more reasonable to associate the histological changes it presents with that presented by the bones. Thus, one understands that rickets is not a disease of the skeleton in the strict sense of the word, but an anomaly of development that manifests itself in all the parts in which at that period phenomena inherent in the evolution of the individual are, as a rule, met with. The liver, however, does not diminish as it should, but remains large, as in persons of minor age. Associated with the phenomena of defective skeletal ossification are sometimes those of exuberant lymphatic production, especially in the parts where the lymphatic and lymphoid organs exist normally disposed. Thus is delineated the clinical picture of the rachitic in whom one can observe, according to the cases, besides the skeletal phenomena, many other visceral phenomena special to lymphatic constitutions.

And here clinical experience comes in, showing us how, in the majority of cases, the rachitic manifestation begins, and later on scrofulous manifestations declare themselves. Thus, also, the symptoms of scrofulosis may precede those of rickets, and finally, when this is cured, tuberculosis may take its place, and the tubercle develop in the markedly lymphatic or lymphatic scrofulous environment.

When I think of these infirmities, and the eager quest of specifics for their cure, and the bitter delusions which follow, I feel the necessity of taking a new road and of stimulating the facts of natural history to give more sapient responses than the theories studied, because often all the fundamental phenomena of scrofula and of rickets are derived from an error of evolution, from the persistence of embryonic conditions that in the development of man indicate the phylogenetic note, where, under the anatomical appearance of the ordinary connective tissue, of the ordinary cartilaginous and bony tissues, are functional activities, which we call precisely inferior *biochemical* activities.

Gout, the disease of deep thinkers, of high livers, according to what is said, which for some is represented by an excessive production of uric acid, is a malady neither of deep thinkers nor of high livers. In these expressions we see hidden an error, an exaggeration, a quite incomplete theory, which, therefore, is unworthy of attention.

Comparative anatomy and embryology indicate a remarkable fact—namely, that birds are descended from reptiles, and that both are distinguished by the production of uric acid.

This fact alone is sufficient to show us that when, in the higher animals—in man—an excessive production of uric acid takes place, excluding, of course, cases of febrile diseases and other fictitious causes, we are confronted by a fact which appertains to the inferior organization, and which in man modifies the general constitution, assuming morbid appearances.

From this point of view, the experiments instituted to study the pathogenesis of gout—that is, introducing artificially uric acid into the human body—have not the value expected from them by the investigators.[1]

And the reason is clear. First of all, uricæmia and gout are not synonymous[1]; in the second place, what interests us above all is to know where and how in some individuals one has an excessive production of uric acid whch is the product of a normal chemical function of lower beings. After this, I think that, when it has been demonstrated where and how the anomalous production of uric acid occurs in the human body, there will remain for solution another question—that is to say, the reason through which the uric dyscrasia in some persons gives rise to the definite clinical manifestations of gout, and this owing to the fact that that particular circumstance which causes in all a passing uricæmia, in some individuals alone *predisposed* to gout sets up the characteristic symptoms. And here, without further insisting on the fundamental notes of gout—for it is not the suitable moment[2]—I shall conclude with the conviction that *one must start from the exact knowledge of the morphological factor which produces uric acid in the lower animals to make its necessary application to the pathogenesis of gout solely as regards the part that refers to its special dyscrasia.*

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[1] It is not necessary for me to corroborate the above assertion by the citation of works and authors, for it deals with known facts, it being my purpose always to discuss things on the basis of undeniable facts. However, for those who may wish to consult them, I mention the work of Ebstein (*Die Natur u. Behandlung d. Gicht*), that of Cantani (*Patologia e terapia del ricambio materiale*), and that of Bouchard (*loc. cit.*). The same critical observation also applies to the earlier experiments of Zalesky and of Chronesky, performed by means of ligature of the ureters.

Comparative physiology teaches that the trophic function, which is known as the function of nutritive reserve, is common to plants and animals, and that in both the starch and fat are equally bodies of organic reserve. And pathology in its turn has shown that when this function of reserve in man exceeds a certain proportion, a pathological state which is a normal one in lower animals declares itself.

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[1] To make all the phenomena of gout depend upon the accumulation of uric acid in the blood would be *une témérité pathologique*, says Bouchard (*loc. cit.*, p. 265). Some years before Bouchard I occupied myself with gout (*cf. Annali universali di Medicina*, vol. ccxliii., 1878), and I made not a few microscopic researches, which lessened considerably the importance attributed to uric acid, besides a brief critical examination of Garrod's theory to prove that the pathogenesis of gout is much more complex than what has been generally admitted; and at the head of my work I placed the following lines of Lehmann, which are equally opportune to-day: "Leider ist der Begriff *Gicht* in der Medicin ein so wager, dass es vielleicht wäre, ihn vorläufig aus der Wissenschaft ganz zu verbannen."

[2] From the classic treatise on gout left us by Sydenham we learn that the gouty may be of coarse and fat corporature, or thin and spare. Although in both cases gout characterizes itself in its special manner as regards the kind of suffering, we can maintain two different cases by reason of the not a few secondary factors and of the treatment. And this signifies implicitly that the application of the morphological doctrines also for this malady will give us some new and useful clinical information. In my work on gout already mentioned I initiated this study, which, perhaps owing to its departure from the predominating theoretical views, has been neglected by those who have subsequently occupied themselves with the question.

Organic chemistry has taught us that both fat and glycogen can be produced in the organism at the expense of the carbohydrates, as well as of the proteid materials, and that the glucose may be produced at the expense of both the fatty and albuminoid materials. The clinic has revealed the relations which exist between obesity, gout, and diabetes ; and the morphological clinic, as we shall see in Part IV. of this book, finds morphological characteristics that are common to these infirmities and characteristics by which they can differentiate themselves in the same way as the functions of reserve can vary, the morphological type modifying itself.

It is now necessary that comparative physiology and pathology, proceeding to new conquests in the knowledge of the trophic functions and of the corresponding morphological conditions, should complete the programme which has been sketched in the things just described.

It is when studying carefully the function of nutritive reserve of organisms that we feel the necessity of extending our knowledge concerning cellular digestion in general, and that of the lymphatic and lymphoid tissues in particular. These which constitute the integral part of the higher organisms are derived by the process of evolution from analogous tissues that, in the lower animals, are found more abundantly distributed, and even constituting the principal mass of the organized being. These lymphatic tissues, therefore, in the scale of beings, have greater or less importance according to where we find the division of organic work is less or more represented. Where the division of organic work is less, they are the place of meeting of the nutrient liquids, and the body grows in proportion to the development of the fundamental tissue. Where it is greater and greatest, the lymphatic tissues, owing to phylogenetic causes, may reach excessive trophic function and development, and consequently become factors of morbid manifestations in the higher organisms.

In fact, physiology, just as it indicates the connective tissue as being the seat of the reserve of fats, also indicates the lymphatic and lymphoid tissues as being the seat of reserve for the albuminoids. And pathology recognizes in the so-called lymphatic subjects an excessive development of the tissues in question, either in the whole of the body or in some of its parts, and understands how the more highly differentiated tissues of the human body may sometimes become languid when in the lymphatic elements there exists more than a reserve of albuminoids—a kind of voracity which appropriates the best part of the food, and gives rise to hypernutrition, to the hypergenesis of their elements, which the clinic, according to the seat and the particular symptomatic manifestations, recognizes by different names ; and all are the morbid manifestations that usually present themselves in the skin, mucosæ, and viscera of individuals originally lymphatic. It is just to admit that when they do not reach the desired degree of development and of function they exercise a deficient influence on the rest of the body.

Perhaps it will be advisable to recall here some facts relative to the transformation of the alimentary substances in our organism, in order to show more clearly the opportuneness of the foregoing ideas.

Whatever may be the importance that the oxygen enjoys in the economy as regards the transformation of the proteids, starches, and fats, we cannot but admit that if the oxygen were absent the said transformations would not have taken place, or would have been incomplete. Besides, the oxygen is not the only influence which acts, inasmuch as there is also the action of the ferments.

It is known that these are of different nature, and are divided into the living and the chemical ferments. These are found dissolved, and produce the breaking-up of certain substances. In the digestive tube some of them transform the albumin into peptone, and this into leucine and tyrosine, and others transform the fat into glycerine and fatty acid ; the starch and dextrine into grape-sugar. In the liver is a ferment that transforms the glycogen into grape-sugar. If it be true what many authorities, including Nasse, Jacobson, Lépine, and Seegen assert, the same ferment is found in the mucosa of the stomach and intestine, in the tissues of the kidney, in the bile and blood. The saccharificating ferment of the saliva and that of the pancreas are also found diffused in the body. And it is known that Brücke has detected the presence of pepsine in the muscles and urine.

Without entering into the discussion regarding the exclusive importance of the unorganized ferments in the organism which arose on the theory of Liebig and has not yet reached a definite conclusion, and as one wishes to comprehend the value of the organized ferments which have been studied owing to the initiative of Pasteur, and whose existence in the body has not been absolutely proved where they would transform the ternary compounds into quaternary ones, we can for the present admit that the importance of these ferments rests in the cellular elements themselves. What is necessary to know above all is the reality of the transformation of these substances which, as it happens, indicates the agent that determines it. It is important to know that these transformations and the relative events which determine them are the same considered in the scale of living beings, so that from the regular or irregular transformations which occur one can infer the function of the determining agents and recognize the facts in their clear naturalistic expression.

According to the researches of the physiologsts, one can say that albumin, peptone, and gelatine are readily destroyed in the economy. The starches and fats, on the contrary, are less readily destroyed, whether the latter come from the fats introduced, or are derived through the digestive activity from the albumin.

Well, when we have been made to understand that the alimentary materials are not destroyed in our economy in the ordinary way, must we not suspect a change in the functioning organic state of the cells ? When from the albumin ingested only fat is produced, which is less easily destroyed; when, in spite of the muscular work, that seems capable of favouring the destruction of starch and fat ; when, in spite of the most rigorous hygiene, the uricæmia does not disappear ; when, in spite of the most careful treatment of diabetes by means of a nitrogenous diet, we do not succeed in impeding the production of glucose, I believe we have to deal with a change in the agents which determine the organic fermentations. I believe one can suspect a transformation in the organized and unorganized ferments. I believe that we are in the presence of a problem of the highest importance, for it concerns a fundamental law of biology.

Some authorities admit that obesity, gout, diabetes, rickets, etc., are to be considered as diseases due to slowing of the metabolism (Bouchard) ; Lecorché wishes to except especially uricæmia and gout. But I believe that in these special conditions of human pathology one has to deal neither with slowing nor with acceleration of metabolism, but with its true perversion and degradation.

In the quality and quantity of the product of the organic transformations we see a fact which is more special to the lower organisms, though in the quantity produced we can admit that in some cases it represents a slight anomaly compatible with a state of relative health and even of perfect health.

I have said that these ideas disclose a problem which concerns a fundamental law of biology, and now I shall explain myself. How can we conceive different physiological properties in the ferments without thinking of the affinity experimentally demonstrated of some species of microbes, and consequently of the transformation of the species of ferment ?

I do not wish to enter further into this grave and dangerous discussion, for I am convinced that there remains very much to be discovered in this world of the unknown before one can arrive at a definite conclusion.

Returning now to our subject, we shall dwell for a moment on what happens in the normal state of things. When the juices that reach the cells are normal, and these are working according to their nature, we see that the nitrogenous materials are eliminated in the required proportions, and the elimination of carbonic acid reaches its maximum ; the starches are completely destroyed, no sugar appears in the urine, and the fat does not accumulate beyond measure in the organism.

But if the functioning organic state of the cells change, the quality of the diet remaining unchanged, and if we see abnormal substances appear in the secretions, or an accumulation of reserve made which ought not to have been made, it appears to me that at least one must suppose the possibility of a modification of the ferments to institute researches which would directly benefit our knowledge of some morbid processes.

The comparative physiology of the digestive process must also contribute to the progress of our knowledge regarding what is indicated by the names *environment of the organism*, *environment of the part.*

If, as morphology, physiology, and pathology teach, in man one must recognize, besides the difference in race, individual differences, how can one continue to consider systematically the media concerning the bodies which the secretions present as the product of the functions of the internal environment ? When the digestive process, when this biochemical work of the cells, correspond to a definite morphological condition, it is very natural to admit that in the presence of the same morbid causes the tissues, organs, and the whole body behave in a special way.

We can admit that among the morbid causes there are not only those which exercise their action on every individual without exception, but also those that act by preference on some individuals, and do not act in the least on others. Daily experience teaches us that which happens in fact, but the study of the reason through which it happens has not yet been initiated on this ground, for, repeating an expression of Preyer, it is necessary to rehabilitate physiology, directing it to study its arguments on the basis of evolution.

If I do not err, from these considerations arises a series of questions now more than ever held important. While one speaks of morbid causes and organic receptivity, the mind runs spontaneously to those causes whose study has led to the bacteriological theories. The mind, after due consideration, pictures to itself innumerable forms of pathogenic bacteria, and daringly confronts one of the gravest questions of the day. Is the parasitic doctrine—I do not say considered in its details, but in some side of its base—absolutely inaccessible to criticism ?

The parasitic doctrine has entered the field on which the last struggles concerning *spontaneous generation* took place.

The experiments of Pasteur triumphed, and the *omne vivum ex ovo*, which up to then one can maintain, was nothing but a controversial opinion, passed into the range of general laws.

Consequently, just as fermentation does not take place in fermentable liquids if the ferment-microbe do not arrive in them from the external environment, and as fermentation is nothing but the product of the germ, which prodigiously multiplies itself, and of the bio-chemical activity of the ferments, so also into the human body penetrate from the outer world the germs, bacteria, through whose work alone the morbid process arises.

The pathogenic bacteria found in the human body can be derived only from other bacteria of the same species, because *omne vivum ex ovo*.

In my opinion this general law has not been happily interpreted, and is abused every time it is invoked to explain facts, which, nevertheless, remain unexplained, and every time facts are denied which, according to the conception of the above-mentioned law, are not impossible.

By reason of this, many inconsistencies that show themselves between the phenomena observed in individuals (infective diseases), or in masses (epidemics), and the dominating doctrine, are ignored, or are forced to submit themselves to the theories with gratuitous suppositions. And such is the conviction generated in the majority, such the enthusiasm of the seekers for new facts, that it appears impossible to them that arguments can be found against the new doctrine. And, extremely proud of the victory gained over the supporters of spontaneous generation, they consider every slight criticism, every reasonable doubt regarding the dominating doctrine, as a proof of ideas almost contrary to nature, and of a tendency to revive the refuted theory of the heterogenists.[1]

Nevertheless, even in homage to the general law of *omne vivum ex ovo*, not a few doubts can be expressed. Even accepting it in its entirety, we can refer those who recognize it as the supreme law to its more rigorous application.

Therefore we shall apply this law according to what the majority think as to the origin of certain morbid processes which are called infective. The bacterium of typhoid fever, for example, is introduced, they say, with potable water.

But is this absolutely true ? Is it always true ?

Very many will answer, " Yes."

I shall be prepared to agree with them when they bring forward well-founded presumptions, otherwise no.

And if he who thinks differently will purpose to demonstrate to me his fact with the rigour of the positive method, he will have to agree that what he admits has not been *absolutely* proved, what he admits being suggested by some fact or some experience ; facts and experience relative to phenomena which require explanation being arguments of probability that do not include all the possible cases, and not even all the verified cases. Hence the necessity of logical doubt in the presence of every case, both of disease in the individual and epidemy in the masses ; hence the conclusion—the application of the corollary of the above-mentioned supreme law being illogical—that, owing to this, it ceases to be a law, and becomes either an hypothesis for him who reasons without prejudice, or a dogma for the doctrinarians, especially when they believe in excluding the dogmas from the knowable by means of the progress of the science. The supervention of the period of decadence in the *Wasser-Theorie* for typhoid fever gives support to my argument.

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[1] This occurs especially among those who, wanting the necessary knowledge, pretend to interpret in their own way and to judge falsely my method of treating the question when I inaugurated the clinical year 1886-87 with *A Glance at Bacteriology*, though I showed then that, according to the authority of the ablest workers on the subject, many questions were not yet solved, and were undoubtedly fundamental ones.

Not to arrive too hurriedly at a conclusion is for me another equally unalterable law. But even this law—the moderator of the mind, the inspirer of new researches, the guide to reason always unsatisfied, because the path of knowledge is infinite—must not be imposed systematically, as to-day is systematically imposed the rigorous application of the *omne vivum ex ovo*, interpreted according to the concepts of the dominating theory irreconcilable with other concepts which the facts themselves suggest. It is not the doubt in itself which is useful to science, but the doubt which, in the mind completely free from prejudices, from systematic ideas, logically arises every time that for the explanation of a fact all the possible causes have not been placed under contribution.

Hence it is that the greater and the more important the fact to be considered is, the graver becomes the doubt. The more some of the reconsidered causes figure among the corollaries of the biological laws, the more the doubt, already grave, acquires scientific importance, and cannot be set aside without injury to the science.

Owing to this I have asked myself, admitting that many and even *the whole* of the pathogenic bacteria are found in the external world, has the impossibility of *some* of them arising in the organism been absolutely demonstrated always according to the law of *omne vivum ex ovo* more widely interpreted according to the fundamental principles of morphology ?

This impossibility has not been demonstrated, for up to now the problem has been avoided which concerns questions very different to those agitated by the heterogenists and the adversaries of spontaneous generation, which I do not wish to revive, while I am of the opinion that the phenomena considered by the heterogenists and the adversaries depend upon other laws, neglected up to now, and not in the least in opposition to the axiom *omne vivum ex ovo*.

To deny the possibility of the development in the organism of pathogenic bacteria would mean the non-extension to its ultimate consequences of the biological law of reversion of organic forms, forgetting altogether the study of the necessary relations between the internal environment and the primordial—that is, indifferent—morphological elements, which the more they become an integral part of cellular forms typically evolving, the more they derive from the reversion of these. And from the state of primary or reacquired indifference they may assume a morphological character no longer corresponding to the type of organization of the body to which they appertain. Further, in the microcosm occur facts equal to those met with in the macrocosm. The indifferent elementary forms adapt themselves to the environment, and in conformity begin their revertive transformation, at first chemically, and then morphologically, disintegrating themselves.

Up to here we have followed the known Darwinian laws without offending the *omne vivum ex ovo*, because these primordial morphological elements constituting the cells of the tissues by symbiosis, and therefore by pathological causes disintegrating, are living germs reverted in the zoological scale, returned, so to speak, to their atavic origins, having quasi-cosmic properties in the organic environment of which they formed part.

From this point our study will proceed vigorously without systematic conceptions.

Up till now the ideas on the comparative physiology of the cellular digestive process have guided us.

Observing under the microscope what occurs in many kinds of cells (red and white blood-corpuscles, epithelial and cancer cells), suitably placed in the moist chamber kept at a proper temperature for forty-eight to seventy-two hours and more, I have seen phenomena of cellular degradation, the cell breaking up into its bioplasts (plastidules of Haeckel), the true morphological units of living matter. And I have also seen evolve from these the bacterium cell and other vegetable forms.[1] I am very convinced that it is necessary to extend our observation on the elements which compose the protoplasm of the cells, which Altmann justly calls *colony of bioplasts*, to discover their modifications according to the environment and the possible transformations.

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[1] Also, when studying the inflammatory process (*Observations Relative to the Inflammatory Process.* With a table. *Gazz. med. ital. Prov. venet.*, Anno XXIV, n. 50, 51 ; Anno XXV., n. 2), I followed for a long time phenomena which enabled me to comprehend the organization of the cell in the mode in which Altmann, by means of his special and most interesting observations, demonstrates (*cf. Die Elementarorganismen und ihre Beziehungen zu der Zellen*, Leipzig, 1890).

By means of this new order of observations we shall obtain much more positive knowledge as regards the internal environment that in each one of the arduous questions which arise in pathological bacteriology is mentioned without knowing it, is accused gratuitously, is adduced to explain nothing less than the phenomena which perhaps owe their origin to different causes.

By means of these new observations, reclaimed from the general principles of morphology, we shall not only know the internal environment, but shall also understand the possibility of particular environments in every part of the body as the result of its special organization.

And from now onwards, following these concepts, we shall recognize the importance which some partial and general phenomena of the organism possess in the sense we have mentioned in respect to the individual difference. Therefore we shall see the necessity of not generalizing too much an idea even if positive, besides the danger that is run in forcing a theory to explain all similar complex facts when, owing to the law of variation, they are not identical.

Following these conceptions, one comprehends that the external environment can modify the internal environment—that the diplococcus, for instance, of the saliva can become the pneumococcus of pneumonia, and another time the meningococcus; that the tubercle bacillus can be introduced into the body, and develop in it, and so on.

It is not Bechamp's theory which I desire to recall, but some facts that it contains, and that, instead of being neglected, must be examined from a new standpoint.

The parasitic doctrine remaining in the one-sided direction it has had up to now, I find the following expression of Torti very opportune: *Inter istas conjectures subsisto, nec ulterius trascendere suppetit animus, easque expono uti tantum probabiles; nec tamen ullum ipsorum* (*omnes*, I would say) *adopto.*

Bizzozero, one of the most authoritative and warm supporters of the parasitic theories, one day asked me, almost censuring me, why I had so much reticence as to facts which were generally admitted. And I myself in return, having distinguished well hypotheses from facts, demanded of him the following question: "Do you believe there is nothing more to learn concerning the biology of the tubercle bacillus" (of this he spoke especially), "and so of the others?" Bizzozero conscientiously replied that there was much yet to learn and investigate regarding the biological history of the infinitely little. "Then," I replied, "you cannot censure, but must approve of my reticence and doubts." I believe he will never approve of them. Nevertheless, I am convinced that it is one thing to say that to-day our science has reached a certain point, and quite another thing to believe that what it has done and said is undeniable. Either criticism will render us cautious or future experience will make us recede. Here also it is a question of variation of cerebral organization, to the extent of making new homage to the insuperable law of the variation of the being.

PART III

METHOD PROPOSED FOR DETERMINING THE INDIVIDUAL MORPHOLOGICAL VALUE OR TYPE

This method consists of the following parts :

I. Measurement.
II. Inspection.
III. Anamnesis.
IV. Present state.

The second and fourth parts constitute what is commonly called the objective examination. The anamnesis and objective examination, it will be said, are regularly adopted by every physician for revealing the morbid state of every individual. Hence, my method would reduce itself to measurement alone.

Apparently this is so, but in reality, as we shall see, I have special reasons for numbering and arranging in the order which I have followed the parts constituting the method that I propose.

By measurement I obtain the data which are confirmed—or, better, specialized—by those of inspection and anamnesis.

With the anamnesis and inspection, conducted with certain precautions, which are inferences from the fundamental principles of morphology, I obtain the physiological and pathological history.

Therefore the examination of the present state consists not only in inspection, percussion, auscultation, microscopical and chemical examinations, but also in all that which semeiotics teaches.

I. Measurement.

I anticipate at once an objection which some reader will make at the idea of having to measure patients.

He will say : " This affair is too long, and in some cases even impossible."

" It is not so," I reply.

In the measurement of the body, as in every other scientific research, difficulties will be met with at first. When it will have been practised a good number of times in the cases in which it can be made conveniently, one will have acquired not only the amount of skill necessary to avoid the least cause of error, but likewise the capacity to recognize by means of simple inspection the more notable disproportions of the body.

Methodical measurement is necessary for exercising the eye to discover the proportions of the parts, and consequently to assume the morphological criteria which are hidden in them, in order to make use of these criteria for the discussion obligatory in every concrete case.

Experience has taught me that, after having made known to my pupils a given morphological type, and then another which is its direct opposite, they readily succeed in comprehending the series of intermediate cases.

The relations that exist between the proportions of human bodies and their configuration, as well as the habitude contracted to refer to this, particular properties or particular physiological and pathological attitudes, give us the capacity of a ready and positive generic judgment even independently from the methodic measurement. This, however, each time it can be made, helps not a little to the intimate knowledge of the individual, and to the continuous criticism to which the physician must subject his own opinions and scientific conceptions.

The measurement, therefore, must be made for learning to value morphological relations up till now neglected ; for teaching us to grasp these relations quickly and securely. It must be repeated as often as is necessary to remove any doubts from the judgment.

If there be cases in which it is impossible to practise it, this does not mean that one must reject a proposal which aims at enriching the terms of our physio-pathological argumentations. There are many other researches which cannot be instituted on every patient, and notwithstanding this they have been included among the clinical armamentarium.

Besides, I willingly admit that, after my day, the question will without doubt be better presented and more clearly understood; but meanwhile we do not wish it to be impoverished and strangled by preliminary censure, which is the enemy of every initiative.

The measurements which are concerned in the study of every patient will give us the numerical idea of the relations of development between the different parts of the organism. Therefore, continuing my researches, ably assisted by the work of my students, I have succeeded in inventing a method of human somatometry that I can call the ideal of what I made use of in the early days of my researches. In this second edition, therefore, I shall introduce all that which has been published by my coadjutor, Professor G. Viola, in his *Description of an Anthropometric Technic for Clinical Use*,[1] as well as other matter collected on the same scientific method by other students of mine.

Before proceeding to the measurement, it is necessary to mark certain *surface markings* which almost all correspond to skeletal parts readily discoverable. Those which are marked on the soft parts admit of no difficulty.

The surface markings that must be duly marked with a dermographical pencil are:

1. *Jugulum:* The pencil will mark the upper border of the sternum, limiting the jugular fossa.

2. *Manubrio-sternal symphysis:* This, in the majority of the cases, is indicated clearly by the transverse projection of the articular line. In the cases in which the prominence is not revealable, a line is drawn transversely on the sternum, which passes through the centre of the breadth of the second rib.

3. *Base of insertion of the ensiform apophysis:* Passing the finger over the region, in the large majority of cases one feels distinctly the articular line. When it cannot be felt, the point of union of the epigastric costal arches with the border of the lower end of the gladiolus of the sternum serves to indicate this surface marking.

4. *Umbilicus:* A line is drawn which cuts transversely the centre of the umbilicus.

5. *Superior margin of the symphysis pubis:* Readily revealable by palpation, making the skin glide gently over it.

6. *External malleolus:* A line is drawn that cuts the centre of this transversely.

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[1] *Il Morgagni*, n. 5, 1902.

7. *The fourth rib anteriorly.*

8. *Epigastrium :* A transverse line is drawn corresponding to the epigastrium at a distance from the insertion of the ensiform apophysis equal to half the total sternal length (excluding the xyphoid appendix).

9. *Acromion apophyses :* The most projecting point of their external margin.

10. *Apex of the axillary cone :* With the arms raised above the head.

11. *Articular line of the wrist :* On the dorsal side, which is easily determined by palpation, while the hand is repeatedly flexed and extended.

12. *External occipital protuberance ;* or, when the head is bent forward to disclose the curve of the cervical vertebral column (see below), the *postero-inferior surface of the occiput* in the immediate neighbourhood of the first cervical spinous apophysis.

13. *Intervertebral median line :* Situated between the first dorsal and the seventh cervical spinous apophyses.

14. *Intervertebral median line :* Situated between the first lumbar and the twelfth dorsal spinous apophyses.

15. *Lumbo-sacral articular line.*

16. *Sacro-coccygeal articular line.*

The determination of the surface markings referring to the intervertebral spaces between the spinous apophyses is very uncertain in fat individuals, owing to the difficult enumeration of the spinous apophyses, especially the lumbar, and the lumbo-sacral articular line is also frequently uncertain. The first dorsal, on the contrary, is readily definable, for it markedly projects immediately beneath the seventh cervical. When at this level we meet with, as we frequently do, two spinous apophyses very projecting ; the superior is the seventh cervical. The twelve dorsal apophyses, which one must count to find the first lumbar, are very often masked by the subcutaneous fat, the dorsal muscles, and the interspinous ligaments. Hence, it is necessary to make the patient bend his back strongly forwards, so as to render the spinous processes as prominent and as wide apart as possible. Then one runs two fingers from above downwards on the spinous apophyses, compressing them between the fingers, and counting them as the fingers pass over them.

Having marked on the skin of the subject these sixteen surface markings, one proceeds to take the following measurements :

1. *Stature*, or *personal height* (from the vertex to the sole of the foot).
2. *Great aperture of the arms*, or *stretch* (the distance between the tip of one middle finger and that of the other when the arms are extended horizontally in a line with the shoulders).
3. *Jugulo-vertebral diameter* (from the jugular fossa—surface marking No. 1.—to the first dorsal spinous apophysis).
4. *Superior thoracic perimeter* (taken at the level of the fourth rib).
5. *Antero-posterior thoracic diameter* (at the same level, the distance that intervenes between the point of intersection of the median line with the transverse line of the fourth ribs anteriorly and the prominence of the spinal apophysis, which is found at the same level posteriorly).
6. *Transverse thoracic diameter* (at the same level in the point of its maximal development, divided into right and left halves).
7. *Inferior thoracic perimeter*, or *hypochondriac perimeter* (taken at the level of surface marking No. 8).
8. *Antero-posterior hypochondriac diameter* (distance between surface marking No. 8 and the prominence of the spinous apophysis at the same level posteriorly).
9. *Transverse hypochondriac diameter* (at the point of its greatest development on its right and left halves).
10. *Total length of the sternum* (from the jugulum to the base of insertion of the ensiform appendix), divided into lengths of the manubrium and of the gladiolus. Point of division of these two parts, the sternal manubrium symphysis (surface markings Nos. 1, 2, and 3).
11. *Biacromial distance* (distance between the two surface markings No. 9), taken with the arms vertical, and with the arms stretched horizontally at the level of the shoulders.
12. *Biaxillary distance* (distance between the two surface markings No. 10).
13. *Total length of the belly* (distance from the base of insertion of the ensiform appendix to the superior margin of the pubis in the median line), divisible into the xipho-umbilical and umbilico-pubic lines (surface markings Nos. 3, 4, and 5).
14. *Transverse diameter of the pelvis* (distance between the

two most projecting points of the external border of the iliac crests).

15. *Superior extremity*, held vertically downwards (from surface markings Nos. 9 to 11).

16. *Inferior extremity* (from surface markings Nos. 5 and 6; also from No. 5 to the sole of foot).

17. *Length of hand* (from surface marking No. 11 to tip of middle finger).

18. *Breadth of hand* (from the external margin of the metacarpo-phalangeal articulation of the index finger to the external margin of the corresponding joint of the little finger).

19. *Length of foot* (from the posterior border of the heel to the tip of the big toe).

20. *The whole vertebral column and its segments*, cervical, dorsal, lumbar, and sacral (surface markings Nos. 12, 13, 14, 15, and 16).

For making all these measurements we make use of the four following instruments :

The anthropometer.
The metric measure.
The calliper compasses.
The thoracometer.

The Anthropometer.—This apparatus was invented by me, and is represented by Figs. 1 and 2. With it the following measurements are taken :

1. Stature.
2. Great aperture or stretch.
3. Length of manubrium of sternum.
4. ,, gladiolus of sternum.
5. ,, xipho-umbilical line.
6. ,, umbilico-pubic line.
7. ,, lower limb to malleolus and to sole of foot.
8. ,, upper limb to wrist and to tip of middle finger.
9. ,, hand.
10. ,, foot.

In Fig. 1 (see p. 104) the anthropometric table suspended on a strong iron trestle, provided with four casters for easily moving the apparatus, is represented in an almost vertical position (slightly oblique in order to see the play of the table on the trestle). When the table is placed vertically, the individual to be measured (who may wear a shirt which does not interfere with the determination of the different surface markings) stands

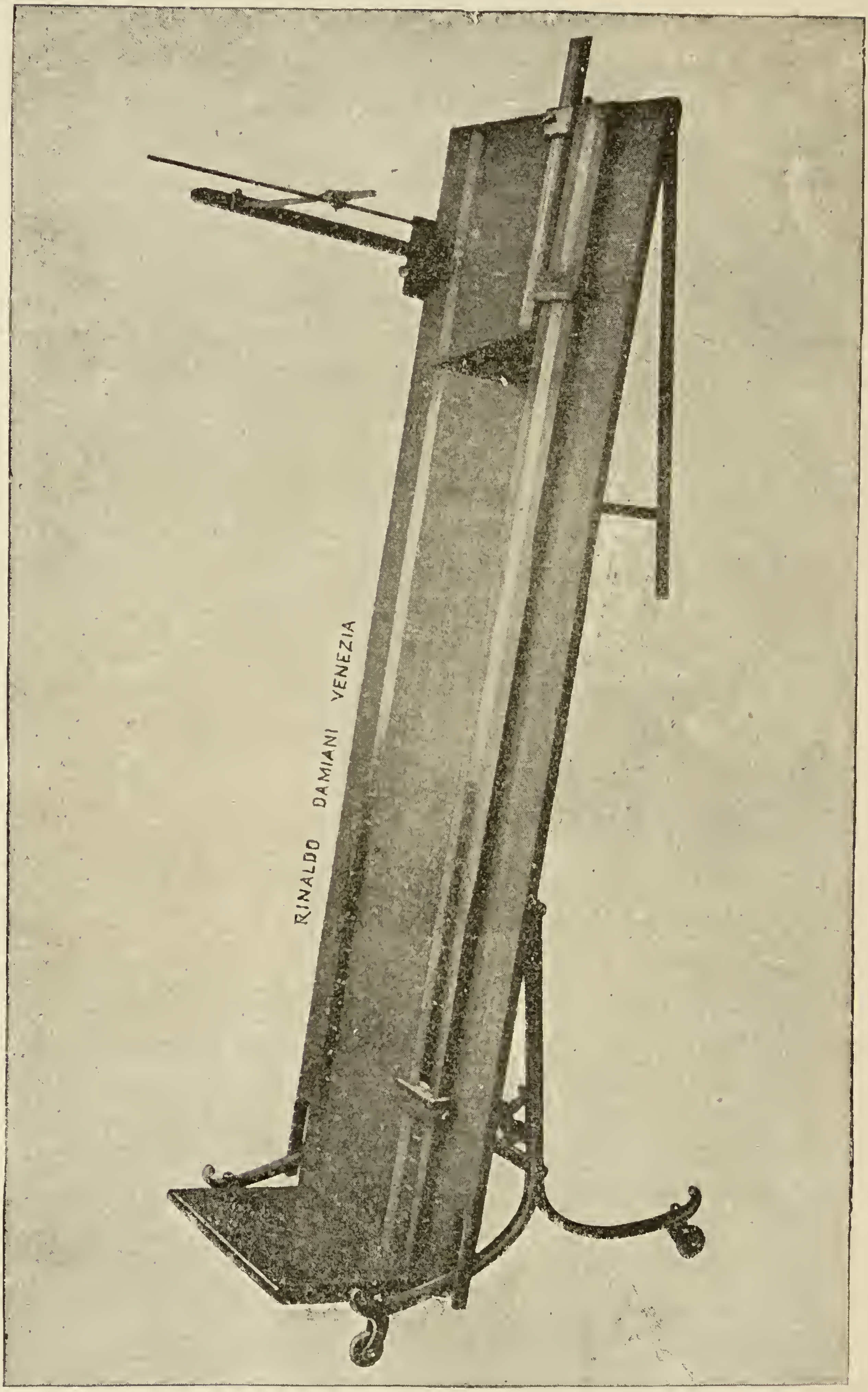


FIG. 1.—ANTHROPOMETRIC TABLE PLACED VERTICALLY.
(Initial inclination to show the movement of trestle.)

with his bare feet on the footboard attached to the lower end of the table, and one requests him to assume with his body the military position of "attention." The subject, standing erect, touches the vertical surface of the anthropometer with his occiput, back, nates, calves, and heels. The feet are brought together, and the black line on the table, which indicates the median position the subject must occupy, naturally must correspond to the middle line of the body, and be included between the feet. The position of the head must be such that the inferior line of the mandible has a perfectly horizontal direction, and the eyes also must be directed horizontally. The shoulders must be naturally falling, abandoned ; the arms extended along the trunk, and the palms touching the thighs. Requesting the subject to remain perfectly still, the table is inclined slowly, lowering its inferior end by means of a handle situated above at the back. This manipulation requires no force, since the table forms on the trestle a lever whose upper arm is longer than the lower. When the table reaches almost the horizontal position, one applies to the vertex the square C, which runs by means of its handle through the staple F, provided with a screw, *e*, which serves to fix the square in the desired position.

At this point the table is placed perfectly horizontal, while at the same time the iron frame connected with the upper end of the table is placed vertically, so that it forms the two legs which support this end of the table.

Fig. 2 (p. 106) represents the subject lying on the table with his arms stretched horizontally at the level of the shoulders. This position is necessary for taking the measurement of the *great aperture of the arms*, or *stretch*. For this purpose there is annexed to the apparatus the wooden staff A B, provided with a metal plate graduated in all its length (2 metres), and two slides, *a*, *b*, fixable at the desired spot by means of a screw. When the apparatus is not in use, the staff A B is attached to the back of the table by means of a small bolt at the top.

Naturally, before the subject places himself on the anthropometer, the staff A B is removed and set aside. At the moment of measuring the stretch the staff is introduced transversely under the shoulders of the subject, and on it are extended his arms with the palms turned upwards, while the slides *a*, *b* are brought into contact with the tips of the middle fingers, and fixed there with the screws. The slides are provided with a vernier, divided into millimetres, which plays on the metal plate inserted in the upper surface of the staff A B, and divided only into centimetres. Thus, one makes the reading at one end and then at the other, and the

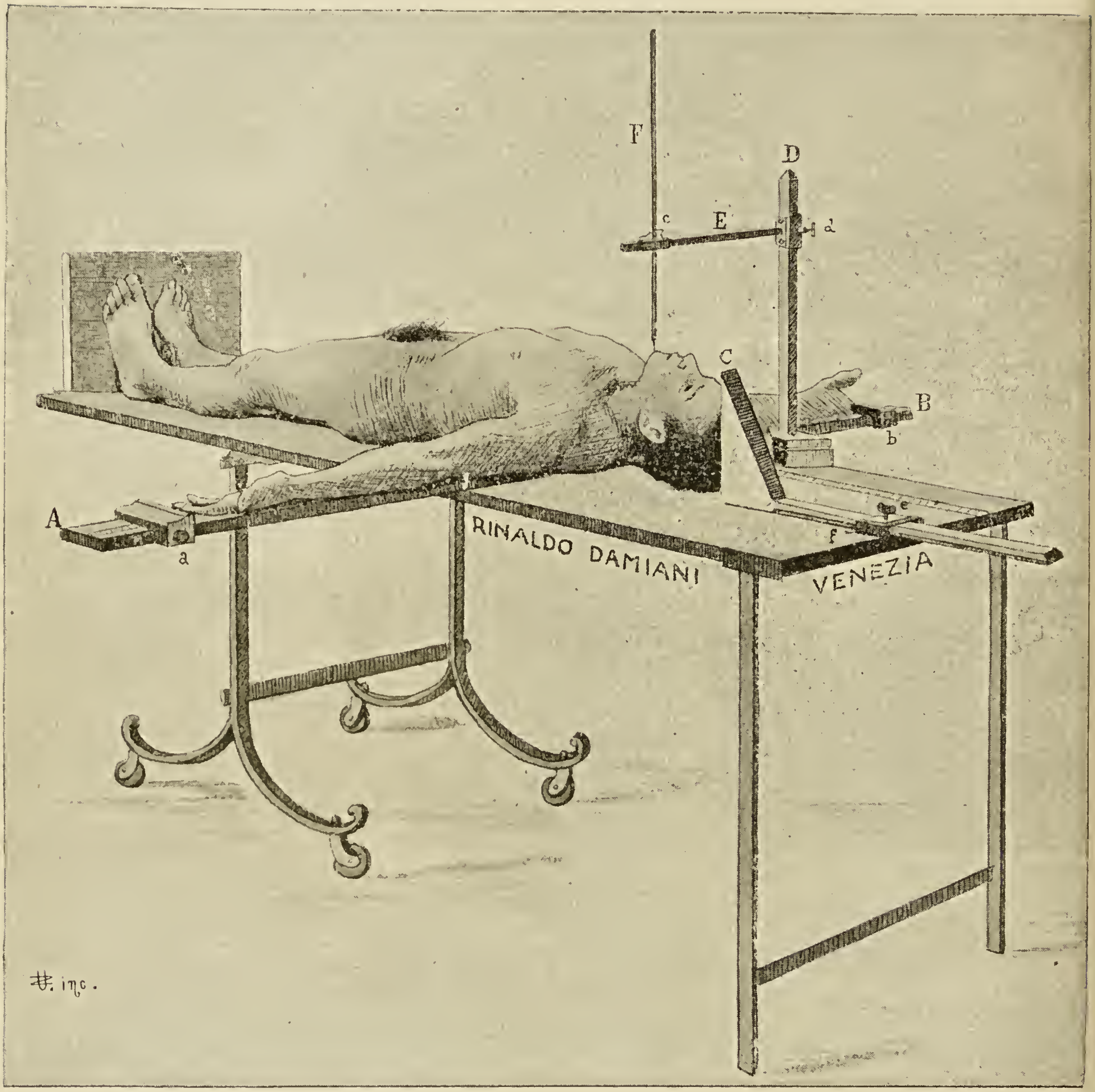


FIG. 2.—ANTHROPOMETRIC TABLE PLACED HORIZONTALLY.

A B, Transverse staff for the great aperture (removable), provided with two slides, fixable with the screws *a b*.
C, Square for measuring the stature, provided with a handle that plays in the staple F, fixable with the screw *e*.
D E, Supporting arms of index F; *c d*, screws for fixing.

sum of both numbers read off gives the measurement of the *great aperture.*

When this is done, the staff A B is removed, and the subject assumes the position with his arms extended along the trunk. Then the surface markings Nos. 1, 2, 3, 4, 5, 6, 9, 11 are marked in the lines on the skin with the dermographical pencil.

On the right side of the anthropometric table is placed the index F, supported by a horizontal arm, E, in which it plays in a vertical and a horizontal direction. The arm E in its turn plays vertically on the staff D, which is supported by a triangular base, furnished with a vernier graduated in millimetres. This triangular base, with its vernier, is freely playable along the right edge of the table on a metal plate that is graduated in centimetres, and inserted in its whole length of 2 metres in the surface of the table near the right edge.

By means of its multiple and easy movements the index F is placed with its point successively in contact with all the surface markings previously drawn, and the reading of each of them on the lateral metric scale gives the distance of the same from the footboard on which the feet rest. From these first numbers, by means of suitable subtractions, one calculates the real length of the following lines :

1. Length of manubrium of sternum.
2. ,, gladiolus of sternum.
3. ,, xipho-umbilical line.
4. ,, umbilico-pubic line.
5. ,, lower limb to malleolus and to sole.
6. ,, upper limb.
7. ,, hand.

The length of the feet is obtained by removing the index F and lowering the arm E till it touches the tips of the big toes. The reading of the distance of the tips from the surface of the anthropometric table on which the heels rest (length of the foot) is made by means of the millimetre vernier playable on the vertical staff D graduated in centimetres.

The *stature*, or *personal height*, is given naturally by the distance of the apex of the square C from the footboard.

Having made all these measurements, the table is placed again in the vertical position, and the subject descends from the footboard.

The Metric Measures.—These are represented by Fig. 3, B B (see below). They are two in number, of very thin flexible steel, 1 centimetre wide and 1 metre long, graduated in millimetres, and provided at one end with a screw, B. The screw C serves to fix them to the thorax during the measurement of the thoracic diameters, as we shall see presently.

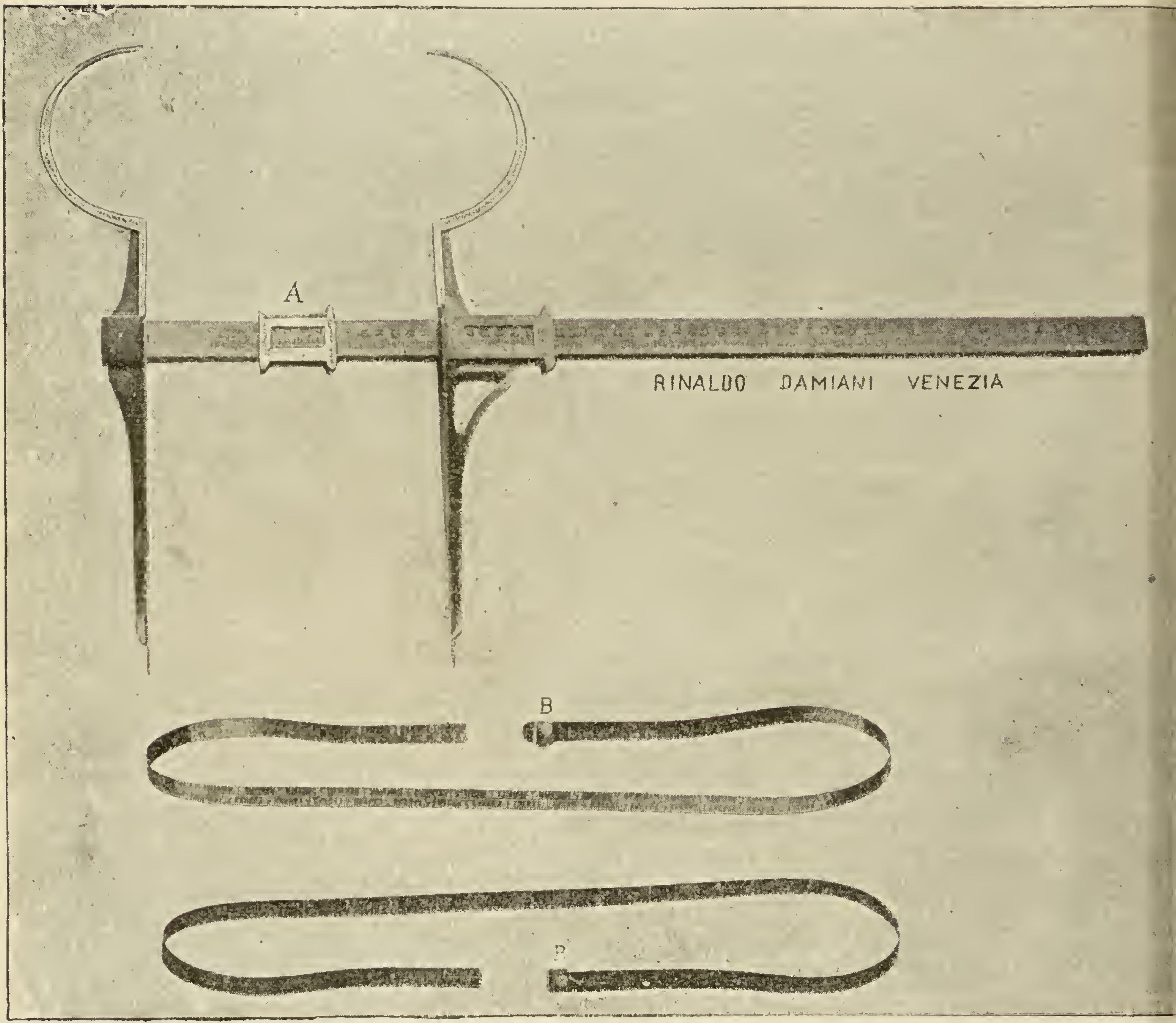


Fig. 3.

A, Calliper-compasses, with median index slidable.
B B, Metric measures.

With the metric measures the following measurements are taken :

Superior thoracic perimeter.
Inferior thoracic and hypochondriac perimeters.
Length of vertebral column and of its segments.

For the measurement of the perimeter, the thorax at the level of the sixth rib (surface marking No. 7) and at the level of the epigastrium (surface marking No. 8) is surrounded by the two metric measures of very thin steel, 1 centimetre wide, furnished with a screw, B, that serves to keep them attached to the thorax.

The subject must keep his hands united behind the nucha, the elbows directed forward in such a manner that the humerus forms about half a right-angle with the line of the back. This oblique position of the elbows is readily judged by the eye, and, besides, small differences of position have no influence on the thoracic perimeter. This position of the arms has the advantage that the scapulæ are raised upwards to the maximum, and are attached perfectly to the thoracic wall. *The respiration must be superficial—that of repose.* Before fixing the measures with the screws one notes the amount of play during the limited phases of ordinary respiration, and the screw is then closed on the mean value between the inspiratory maximum and expiratory minimum of ordinary respiration.

If the individual should now increase his respiratory excursions, he would find in inspiration an unsurmountable obstacle in the rigid measure fixed by the screw, and in forced expiration the measures would slip down, especially the epigastric one.

This does not occur so long as the respiration remains superficial, inasmuch as experience has shown that the measures remain immobile during the small oscillations in size of the thorax, when they have been fixed in the mean position of repose.

The displacement of the measures thus warns us that the subject has changed his ordinary respiration. Since, as we shall see presently, the thoracic diameters are taken, placing the points of the calliper-compasses on the measures (in order to avoid the pressure of the points on the soft parts of the subject, which would give rise to pain and to variable errors of measurement), it is necessary to keep the measures in their original position, which can be obtained only by recommending the subject not to alter his ordinary respiration. This is easily done, and this method of measurement offers us the great advantage of guaranteeing the value of the thoracic diameters as corresponding exactly to the thoracic diameters revealed without the possibility of abnormal respiratory oscillation intervening to modify them.

The measures must be placed horizontally. In the usual measurements this can be guaranteed by the eye, which instinctively corrects any error that is necessary for the thoracic section which is being measured to remain with its surface inclined upwards anteriorly in relationship with the central axis of the trunk, which is never perfectly vertical, but more or less oblique from behind forwards and from above downwards, according to the greater or less depth of the lumbar hollow of the vertebral column. But for determining precisely the position of the measures, we are accustomed to mark it on the median line anteriorly (surface markings Nos. 7 and 8), and posteriorly on the vertebral column.

The metric measures serve also for measuring the *vertebral column* as a whole and in its segments.

For this purpose the subject must be *standing* in the position of "attention." The posterior concavity of the cervical spine is sometimes so masked by the muscles that the relative section is not easily measured.

Hence we have adopted the following position of the head : It is slightly inclined forwards, and bent downwards on its transverse axis till the cervical spinous apophyses project in one plane posteriorly on the median line. The cervical column thus forms with the dorsal a very slight obtuse angle. Owing to the flexion of the head, the external occipital protuberance is raised sensibly, and one can thus reach the postero-inferior surface of the occiput, and against it apply immediately above the first spinous apophysis the beginning of the measure.

The left thumb keeps the measure fixed on the occiput above while with the right hand it is adapted to all the curves of the vertebral column, and as this is done one takes the reading of the part of the measure which corresponds to the surface markings of the different segments of the spine previously marked on the skin of the back (surface markings Nos. 13, 14, 15, 16). Then by means of subtractions the value of each segment is obtained from this first reading.

In this way one avoids the cause of error which would be derived by displacing the measure in the successive measurement of each segment.

The measurement of the vertebral column as a whole does not offer much difficulty, for the extreme surface markings are readily definable. Nevertheless, the inclination of the head must be made with much care, so that the minimum of inclination necessary for the levelling of the cervical concavity is not exceeded.

The calliper-compasses are represented by Fig. 3A (see p. 108). With them are taken the following measurements :

1. Jugulo-vertebral diameter.
2. Biacromial distance (with arms horizontal and vertical).
3· Biaxillary distance.
4. Transverse thoracic diameter } superior (sixth rib).
5. Antero-posterior thoracic diameter } superior (sixth rib).
6. Transverse thoracic diameter } inferior (epigastric).
7. Antero-posterior thoracic diameter } inferior (epigastric).
8. Transverse diameter of pelvis (bi-iliac diameter).
9. Maximal breadth of left hand.
10. Maximal breadth of left foot.

The calliper-compasses consist of a transverse bar graduated in millimetres, and of two vertical legs, one of which is fixed to one end of the bar, and the other is movable. These compasses, made of metal, are hollow, light, strong, and easily managed. The length of the scale is 50 centimetres. They are made on the type of the *compas glissière* of Mathieu, but differ from the latter in the shape of the legs, which are straight in the lower part and curved in the upper, and in the addition of the sliding index A.

The curved portions are used for measuring the antero-posterior thoracic diameters, including the jugulo-vertebral and biaxillary diameters ; the straight portions for the other measures mentioned above.

The index A is a small slide which serves to divide the transverse measurements of the trunk (the transverse thoracic diameters especially) into right and left halves, when, having placed the legs in the position necessary for the measurement, the index is moved in such a way that its left margin corresponds precisely to the median line of the body previously marked on the skin. It is a very simple arrangement, which enables one to measure independently the two halves of the body in general and of the thorax in particular.

For the measurement of the thoracic diameters the subject is in the same position as that for the perimeters. In fact, these diameters are taken *after having fixed the two measures with the screw B*—the one at the level of the fourth rib, the other at that of the hypochondrium. The hands are kept behind the nucha, with the elbows directed outwards and the trunk perfectly erect.

The respiration must be tranquil and superficial, and the *subject must be careful that during expiration the measures are not separated from the thorax, and thus tend to slip down.* In this way the expiration is limited, while the inspiration is controlled by the rigidity of the measures themselves.

One begins with the measurement of the transverse diameters—first at the level of the upper measure, and then at that of the lower; one opens the compasses till the straight portions of the legs include the thorax in all its thickness, and anteriorly the transverse metric bar is distant 12 centimetres from the surface of the body. Then the fixed leg is placed in contact with the measure on the right, and the movable leg is opened till it touches the measure on the left. Then the index A is moved till its left margin corresponds exactly with the median line of the sternum. The compasses are then removed, and the readings of the total diameter, of the right diameter (number marked by index A), and of the left (subtraction of the latter from the former), are readily made.

In the measurement of the antero-posterior diameters the points of the curved portions must rest on the measure, anteriorly corresponding to the sternal median line, posteriorly to the dorsal spinous apophyses, moulding the measure to the parts where it does not fit closely.

We then pass to the biaxillary, and, having lowered the arms vertically to the biacromial, whose measurement is repeated with the arms horizontal on a line with the shoulders. Finally, the bi-iliac is taken, for which one places the two straight portions of the legs of the compasses on the most projecting point of the external border of the iliac crests.

The maximal breadth of the left hand and foot are measured while they rest on a flat surface.

The reason for selecting the left hand and foot is to eliminate from the study of the proportions of these parts the eventual factors of exceptional development (physical exercise, occupations, etc.).

It would be more regular to select the average of the measurements of the right and left parts, but we have adopted what experience has taught us, and, besides, we do not desire to propose unnecessary measurements.

The Thoracometer.—This instrument, invented by Viola for taking the transverse diameters of the thorax at a given point of the antero-posterior diameter, is represented by Fig. 4 (see below).

According to the conformation of the thorax, the transverse diameter may be found more or less anteriorly or posteriorly, in respect to the antero-posterior diameter. If one desires to know exactly the transverse diameter corresponding, for example, with the centre of the antero-posterior diameter, or with any other point of this, it is obvious that the compasses cannot be employed for this purpose.

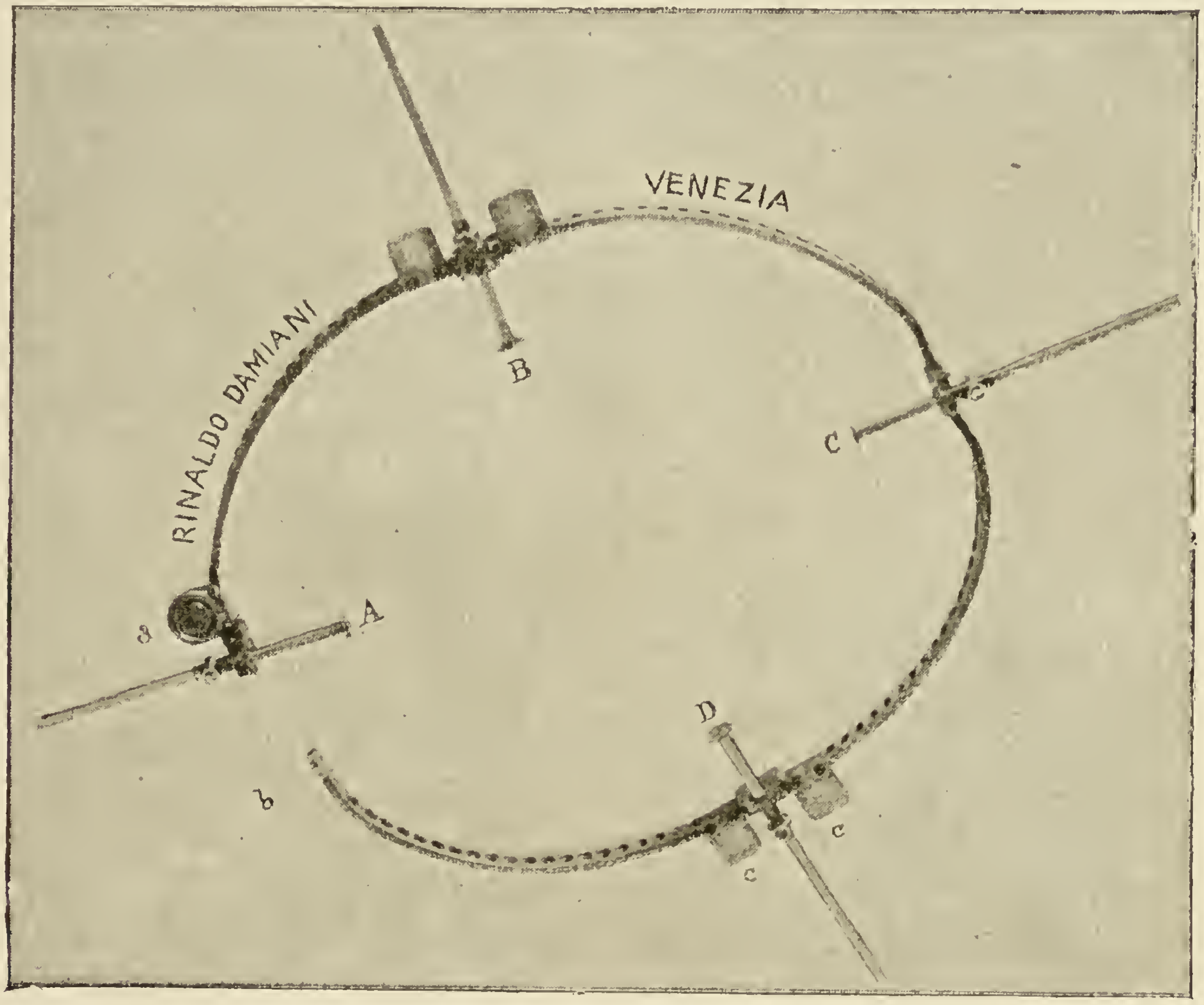


Fig. 4.—Thoracometer for Thoracic Diameters.

a, Spirit-level; *b*, open end of instrument, which is fixed with a pin when the thoracometer is closed, after encircling the thorax, for measurement; *c c*, buttons for supporting the instrument during the measurement.
A, B, C, D, Indices movable centripetally and centrifugally, graduated in millimetres on their upper surface.

The thoracometer consists of a circle of brass, solid, but perforated with holes in its whole length to render it lighter. It is provided with four indices, A, B, C, D, situated at four opposite points of the circle, and movable in one direction (centripetally or centrifugally). These four indices are graduated in millimetres on their upper surface, and each is furnished with a screw to fix it at the desired spot. The graduation is made in such a way that the reading of the millimetres on the upper surface of the indices gives the respective distances of the internal ends, A, B, C, D, from the centre of the ellipse, calculated as point of departure, equal to zero.

The thoracometer opens at *b*, to enable one to encircle the thorax of the subject with it.

In *a* is contained a small spirit-level, which enables one to place and maintain the instrument perfectly horizontal during the measurement.

The thoracometer is used as follows :

1. The indices are pushed home as far as possible.

2. The thoracometer, open, is placed round the thorax at the height necessary to measure, and is then closed. He who follows the measurement places himself beside the spirit-level, and grasps with the thumb and middle finger of both hands the front and back buttons.

3. With both index-fingers he pushes the indices B D internally on the anterior and posterior median lines of the thorax.

4. An assistant reads the two numbers indicated by the two indices, and their sum represents the length of the antero-posterio diameter.

5. Then this measurement is divided into two equal parts between the two indices B and D. Let us suppose that the sum given by the above reading is 18·4 centimetres ; the indices B and D are each fixed at 9·2 centimetres. Thus the thorax happens to be situated exactly in the centre of the instrument.

6. He who supports the thoracometer now pushes the index A inwards, and his assistant pushes the index C also inwards. And each of them takes the reading of his own index, which is kept firmly against the thorax during the reading. Thus the reading of the index A gives the measurement of the right half, and that of index C of the left half, of the transverse diameter precisely at the level of the centre of the antero-posterior diameter.

Now, fixing the indices B and D at different points—that is to say, placing the instrument more or less anteriorly or posteriorly on the thorax—one takes at pleasure the transverse diameters corresponding to the different points of the antero-posterior diameter.

For the position of the arms and the phase of respiration during the measurement, see the paragraph on the calliper-compasses (p. 111).

Limit of Personal Error in the Use of the Instruments.—To reduce to the minimum the causes of personal error in the measurement of different individuals, in our clinic all the patients, and all the healthy individuals who serve as material of observation, are measured by an assistant specially selected for the purpose. This naturally does not prevent the students and others learning and practising the method.

For calculating the limits of personal error the same subject was measured six times following. One understands that, having to verify in a special way the exactness of the instruments used, during the six measurements the marks made with the demographic pencil before the first measurement were not erased. If they had been erased and were renewed, it would have been impossible to distinguish the limits of instrumental error from those due to the possible displacement of the surface markings.

Having marked all the surface markings, therefore, once for all, the subject placed himself on the anthropometric table, and when the necessary measurements were taken he descended from it. Then the measurements with the metric measure, calliper-compasses, and thoracometer were made. Next the measurements with the anthropometer were recommenced, while from the mind of the operator was cancelled the memory of the numbers obtained, and consequently all danger of suggestion was banished, and the subject assumed on the apparatus a new pose (see Table I., p. 116).

The numbers in the table do not represent those of the *maximum exactness possible* with our instruments. They were not obtained in exceptional conditions of scrupulous observation, but with the attention and rapidity *usual* in our measurements.

Consequently, if they do not give us the minimum expression of the degree of approximation, they give us in compensation the expression of the *maximum error possible* with our material of observation, which is for us more useful to know *practically*.

Now, neglecting for a moment the thoracometer, which is used only exceptionally, of the thirty-two usual measurements, twenty-nine present an error which is less than a centimetre, and twenty-five an error which does not exceed half a centimetre.

TABLE I.

RESULTS OBTAINED BY DR. PRA.

Instrument employed.	Measures.	I.	II.	III.	IV.	V.	VI.	Difference between Maximum and Minimum.
		Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.
ANTHROPOMETER.	1. Stature	162·5	162·6	162·8	162·9	162·9	163·0	0·5
	2. Great aperture	166·7	166·5	167·0	166·4	166·6	166·3	0·7
	3. Manubrium of sternum ..	4·3	4·3	4·2	4·3	4·2	4·4	0·2
	4. Gladiolus of sternum	9·0	9·0	9·1	8·8	9·0	9·0	0·3
	5. Xipho-umbilical	24·0	24·0	24·1	24·2	24·3	24·0	0·3
	6. Umbilico-pubic	14·3	14·4	14·3	14·3	14·5	14·3	0·2
	7. Upper limb to wrist	54·9	55·7	56·3	56·0	55·9	56·0	1·4
	8. Upper limb to middle finger ..	72·1	72·8	72·6	73·1	72·9	73·0	1·0
	9. Length of hand	17·1	17·1	16·3	17·1	17·0	17·0	0·8
	10. Lower limb to malleolus ..	75·5	75·5	75·4	75·3	75·5	75·7	0·4
	11. Lower limb to calcaneum ..	82·3	82·4	82·4	82·3	82·4	82·7	0·4
	12. Length of foot	26·3	26·2	26·2	26·2	26·1	26·1	0·2
METRIC MEASURE.	13. Super. thor. perimeter ..	80·5	80·6	80·9	80·9	81·0	81·1	0·6
	14. Hypochondr. thor. perimeter ..	74·4	74·5	74·6	74·7	74·2	75·0	0·8
	15. Cerv. verteb. column	12·0	12·0	12·1	12·2	12·2	12·3	0·3
	16. Dors. verteb. column	32·4	32·6	32·6	32·5	32·5	32·5	0·2
	17. Lumb. verteb. column ..	11·3	10·5	11·1	10·7	11·1	11·0	0·8
	18. Sacr. verteb. column	9·6	10·1	9·8	9·9	9·9	9·7	0·5
	19. Total verteb. column	65·3	65·2	65·6	65·3	65·7	65·5	0·5
CALLIPER COMPASSES.	20. Jugulo-verteb. diameter ..	13·0	13·1	13·1	13·2	13·2	13·2	0·2
	21. Ant.-post. sup. thor. diameter	18·7	18·8	18·9	19·0	19·1	19·1	0·4
	22. Left sup. trans. thor. diameter	12·9	13·1	12·9	12·9	12·6	12·7	0·5
	23. Right sup. trans. thor. diameter	14·6	14·7	14·7	14·9	15·4	15·5	0·9
	24. Ant.-post. hypochon. thor. diameter	18·3	18·3	18·4	18·4	18·4	18·5	0·2
	25. Left hypochon. trans. thor. diameter	11·9	12·3	11·9	11·8	11·9	12·0	0·5
	26. Right hypochon. trans. thor. diameter	13·2	13·2	13·6	13·7	13·7	13·7	0·5
	27. Biaxillary diameter	22·1	22·2	22·0	22·2	22·3	22·2	0·3
	28. Biacrom. diameter (arms extended)	25·7	25·6	25·6	25·7	25·3	25·8	0·5
	29. Biacrom. diameter (arms vertical)	32·2	32·3	32·0	32·3	32·4	32·1	0·3
	30. Trans. diameter of pelvis ..	27·5	27·6	27·6	27·6	27·7	27·8	0·3
	31. Breadth of hands	8·1	8·1	8·1	8·1	8·1	8·2	0·1
	32. Breadth of feet	8·7	8·8	8·8	8·8	8·8	8·9	0·2
THORACOMETER.	33. Ant.-post. sup. thor. diameter	18·4	18·8	18·8	19·2	19·6	19·6	1·2
	34. Left trans. thor. diameter ..	11·2	10·7	11·0	11·2	10·8	11·2	0·5
	35. Right trans. thor. diameter ..	12·4	11·7	11·6	11·9	12·2	11·4	1·0
	36. Ant.-post. inf. thor. diameter	18·6	18·6	18·6	18·7	18·9	19·0	0·4
	37. Left trans. thor. diameter ..	11·2	11·2	11·2	10·4	11·4	11·7	1·3
	38. Right trans. thor. diameter ..	11·9	12·2	12·6	12·5	11·7	12·0	0·9

The following measurements show an error of a centimetre or more :

Upper limb to wrist (anthropometer), error, 1·4 centimetres.
Upper limb to middle finger (anthropometer), error, 1 centimetre.

The cause of error of these two measurements which refer to the right arm cannot certainly be attributed to the anthropometer, which for the other measures gives much better limits of approximation. It depends, I believe, on the natural mobility of the shoulders, and on the more or less forced extension of the forearm on the arm, which it is almost impossible to fix with greater precision.

The following measurements present errors above 5 millimetres and below 1 centimetre :

	Error mm.
1. Great aperture (anthropometer)	7
2. Length of hand (anthropometer)	8
3. Superior thoracic perimeter (tape)	6
4. Hypochondriac thoracic perimeter (tape)	8
5. Lumbar vertebral column (tape)	8
6. Right superior transverse thoracic diameter (compasses)	9

With regard to the *great aperture,* the conditions of observation must be considered very fortunate, inasmuch as it deals with the linear measurement, which is the longest in the human body (approaching 2 metres), and includes both shoulder-joints, which are the *least fixed* of those included in our measurements. Bertillon, with his measuring instruments, gives for the great aperture *a centimetre* as the limit of approximation above or below the real measure, so that he admits a complete oscillation of 2 centimetres in the repeated measurements of this line. We believe that the supine position of the subject on our apparatus permits a greater fixity of position of the shoulders than the vertical position adopted by Bertillon.

The rather notable error of 8 millimetres for the short measure of the *length of the hand* is improbable. In fact, if we examine the six measures taken (*cf.* No. 9 in table), we see that only *one* of them differs notably, while the remaining five give a maximal variation of 2 millimetres. I believe I am not mistaken in maintaining that the third measure has been altered by some accidental cause.

If one take into consideration the grave difficulties met with in the measurement of the *thoracic perimeters* (respiratory movements, variable tightness of the metric measure round the thorax), the error of 6 to 8 millimetres can be considered of little importance. In fact, I believe that one can present it as a criterion of the undoubted reliability of our method of thoracic measurement. Inasmuch as the subject was measured each time after an interval of twenty to thirty minutes, the great constancy of the results obtained clearly demonstrates that *the superficial respiration of repose maintains the thorax at a fixed limit of size* in a state of mean equilibrium, which is the most suitable for the measurement.

The justice of these remarks is confirmed by the excellent results of the measurement of the *thoracic diameters*, in which the limits of error are all inferior to those of the perimeters, sometimes not worthy of notice (2 millimetres). Nevertheless, the same grave causes of error which have been mentioned for the perimeters also affect them.

The lumbar section of the vertebral column has given an error of 8 millimetres. I believe that this must be ascribed to the variable curvature in relation to the greater or less erection of the trunk, which is difficult to determine.

Taking into consideration the fact that these six successive measurements were taken quickly, *without special precautions for the greatest exactness*, I believe that the results obtained can be considered satisfactory, and at least more so than those obtained by other workers with different instruments. And for the reliability of the anthropometrico-clinical researches, it will be sufficient for one to trust to the following general rule :

With the use of our instruments the following measurements may oscillate above or below the real to the extent :

Thoracic perimeters	of 5 mm.
Great aperture	
Lumbar vertebral column	
Upper limb	of 7 mm.
All the other measurements	of 2·5 mm.

Therefore in the valuations made on the results of the measurements, in the comparisons between individual and individual, etc., the deficiencies or excesses which for the upper limb held vertically are only 1½ centimetres ; for the thoracic perimeters, great aperture, and lumbar vertebral column only 1 centimetre ; and for all the other measurements ½ centimetre can be neglected.

FACSIMILE OF ANTHROPOMETRICO-CLINICAL SCHEDULE.

Age.	Occupation.	NAME.	Year.	Morphological Combination.	No. of Register.
....	....	....	....	....	....

Stature.	Great Aperture.	SUPERIOR THORACIC SEGMENT.				MEDIAN THORACIC SEGMENT.					HYPOCHONDRIAC THORACIC SEGMENT.					Sternal Length.	
		Biacromial (arms extended).	Biacromial (arms lowered).	Biaxillary.	Jugulo-vertebral.	Perimeter.	Diameter, antero-posterior.	Transverse Diameter.			Perimeter.	Diameter, antero-posterior	Transverse Diameter.			m.	c.
								Left.	Right.	Total.			Left.	Right.	Total.		
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

Abdominal Length.			Pelvis. Transverse.	Upper Limb.		Hands.		Lower Limb.		Feet.		Vertebral Column.				Total Weight.	
x.u.	u.p.	Total.		Wrist.	Middle Finger.	Breadth.	Length.	Malleolus.	Sole.	Length.	Breadth.	Cervical.	Dorsal.	Lumbar.	Sacral.		
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

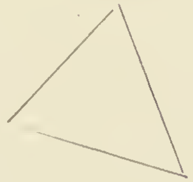
Nutrition ....

Venous system ....

Lymphatic system ....

Physiological tendencies ....

HEART.

......  ......

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DIAGNOSIS AND OBSERVATIONS.

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Minor precision results from the use of the thoracometer, for which the maximal error is frequently about a centimetre (see p. 116). This is due to the fact that the pointed indices of the instrument, owing to their small surface, sometimes fall between the ribs, at others rest on them.

With the employment of the compasses and the metric measures this inconvenience is avoided.

As we have said before, the use of the thoracometer is confined to those special cases in which it is necessary to know not the maximal transverse diameter, but the maximal diameter the thorax measures at a given point of its antero-posterior diameter.

Anthropometric Schedule.—The numbers of the measures obtained are registered in a form which includes the clinical history of the patient, and of which an example is given on p. 119.

The schedules are then arranged together in the form of a register. In them are included, besides the measures, many other indications regarding the most notable data furnished by the other parts of the individual morphological examination, such as the *nutrition*, the development of the general *venous system*, of the *lymphatic system*, the physiological tendencies to eating, drinking, etc., the development of the right and left parts of the *heart*, determined by my method of triangulation, the corporeal weight The schedule also contains the indications of the generalities of the subject, the number of the register of his clinical history in order to be able to refer to it in the archives of the clinic, the indication of the diagnosis, if it deals with a patient, and the indication of the morphological type or combination, in which he has been classified on the basis of the result of the full morphological examination.

At the back of the schedule are given the main general anthropological characters : *hair* (form, quantity, colour), *skull* (length, breadth), *forehead* (height, form), *head* (form), *face* (length and breadth), *eye* (shape), *iris* (size, colour), *skin* (elasticity, colour), sexual notes.

Anatomical Anthropometric Schedule. — Inasmuch as these studies depend above all on the anatomical investigations which aim at establishing the relations between the external and the visceral measurements, thus other anatomical anthropometric schedules are used for registering the results obtained from the measurement of cadavers (external measurement, as in the living

FACSIMILE OF ANATOMICAL ANTHROPOMETRICAL SCHEDULE.

Date.	NAME. Nationality and Occupation.	Cadaver obtained from	Age.	Weight.	Stature.	Great Aperture.	THORAX.				ABDOMEN.			
							Per.	Diam. a.-p.	Diam. Trans.	Sternal Length.	Circ. Hypo.	Xypho. Umb.	Umb.	Bi-il.
......	....	....	......	......	......	......	......	......	......	......	......	......	......	......
......	....	....	......	......	......	......	......	......	......	......	......	......	......	......

Upper Limbs.	Lower Limbs.	VERTEBRAL COLUMN.										STOMACH.		INTESTINE TOTAL.		SMALL.		LARGE.		LIVER (weight).
		Real Length.					Cord.													
		Total.	Cerv.	Dors.	Lum.	Sacr.	Total.	Cerv.	Dors.	Lum.	Sacr.	Weight.	Capacity.	Weight.	Length.	Weight.	Length.	Weight.	Length.	
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

OBSERVATIONS.	NECROSCOPIC FINDING.

HEART.

Weight.

Cardiac index.

N.B.—This space is reserved for the tracing of the cardiac perimeter.

subject, weight, capacity, and dimensions of the viscera). I give here the facsimile of those which have been used by Messedaglia and Vainanidis for their studies, already in part published (see p. 121). A blank space in the lower part of the schedule is left for tracing the outline of the heart extracted from the cadaver after the large vessels have been tied. Thus, the triangulation made on the living subject according to my method is controlled by the dimensions of the cardiac perimetric tracing. With regard to the technique of this anatomical part of the morphological investigation, compare the essay of these workers.[1]

Contours of the Human Body.—Finally, the study of the forms of the human body is completed by the projection of the contours *in front* and *in profile.*

The projection is obtained in the following way :

Fig. 5 represents one of the simplest of the common anthropometers which serve for measuring the stature. However, it has been modified in this, that the movable square, which is lowered on the vertex, is provided with a long arm, A B C, that projects beyond the subject when he is standing on the apparatus. On the upper surface of this arm plays a small wooden box, B, which contains the plumb-line when the apparatus is not in use.

The box is pushed towards the end of the arm till the plumb-line falls immediately in front of the subject. Behind the box is an index, C, arranged transversely, and which also, like the box, can be moved in an antero-posterior direction.

The subject must be completely nude, or, when this is not possible, as occurs sometimes for women, covered round the hips with a thin and smooth material that does not alter sensibly the lines of contour. He must stand on the apparatus so that the plumb-line cuts the median line of the body, and falls on both big toes, and the heels rest on the white line which passes transversely on the footboard of the apparatus, and the index C is placed transversely on the vertex at the level of the forehead. The arms and hands must be extended, with the palms turned forward, and the wrists must be 25 centimetres distant from the iliac crests. On the skin of the trunk are marked with a *black* demographic pencil the jugulum, the insertion of the xiphoid appendix, the whole of the bilateral costal arch, and where the

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[1] *Riv. di Sc. med.*, anno XVIII., fasc. xi., December 15, 1901. L. Messedaglia and A. Vainanidis, *Dei rapporti fra alcune misure esterne del corpo umano e lo sviluppo di alcuni visceri dell'addome* (Nota preventiva).

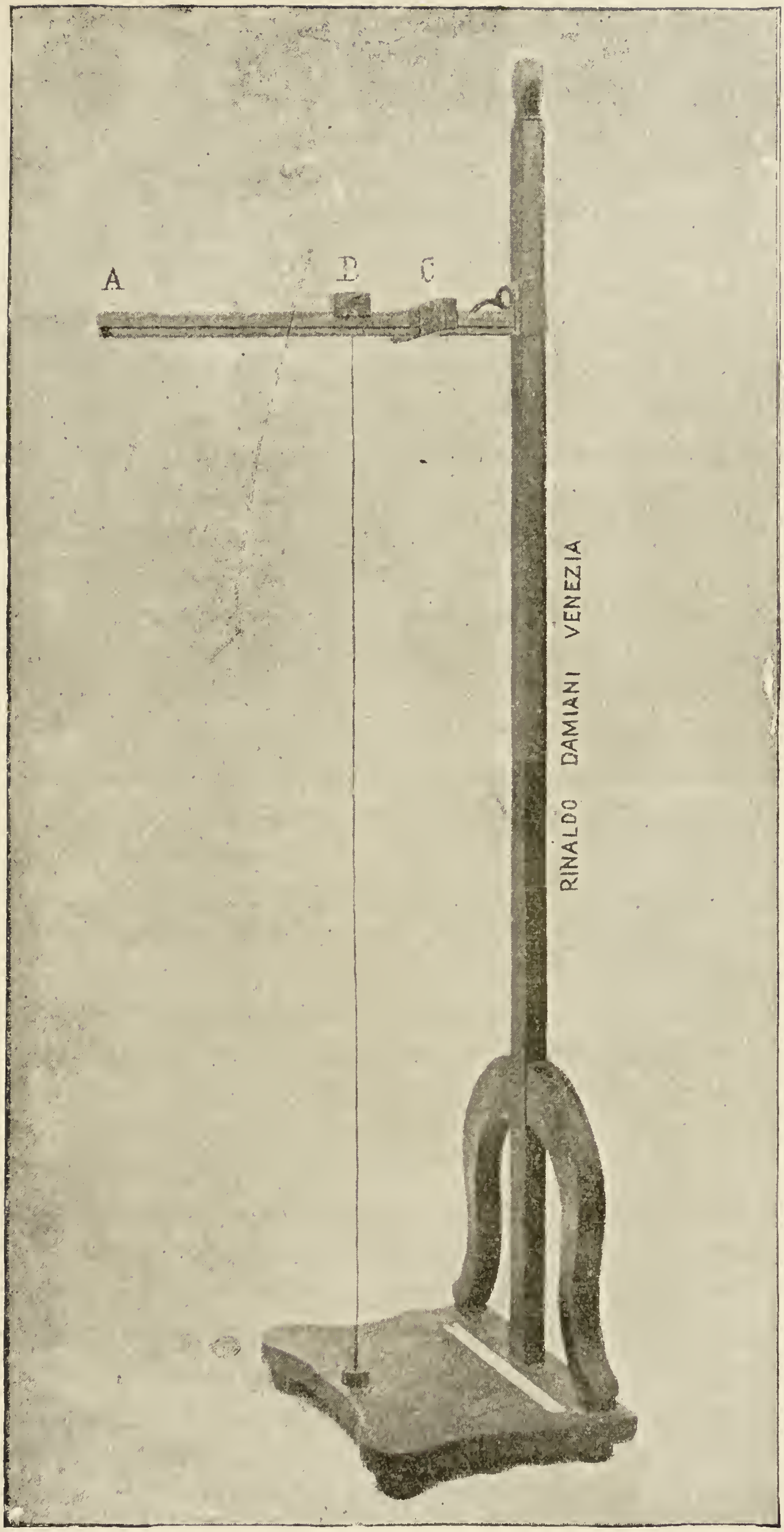

Fig. 5.—Anthropometer adapted for the Exact Photographic Relief of the Contours of the Human Body.

A, Movable horizontal arm that rests on the vertex; B, box containing the plumb-line; C, movable transverse index, which is placed on the vertex at the level of the forehead.

hair does not prevent it, the superior margin of the pubis ; when it does, the level of this line is drawn laterally on the inguinal region. Having thus prepared the patient, the photographic machine is placed in such a way that the centre of the objective is at the level of the umbilicus, and in this manner the *front-view photograph* is taken.

For the profile photograph (right), the subject, placed in this position, must have the white line of the footboard between his feet, the index C on the centre of the vertex, and the plumb-line must pass in front of the following surface markings : the tragus, acromion, depression between the external margin of the olecranon and the epicondyle, external border of the patella, anterior margin of the malleolus. The whole of the trunk and the extended arm thus find themselves in the desired position. The perfect position of the profile is, however, decided by the eye of the observer, but this presents no difficulty.

When the negatives are developed, they are immediately put into the projection machine, which is placed on a small revolving table movable in every direction, so that it can be arranged in such a way that one can have on the screen the projection of the negative at such enlargement that the distance between the index C and the white line of the footboard is 170 centimetres.

Thus, all the contours of the human bodies are brought to the same development, and designed on transparent paper, following the contours with the pencil with great facility and exactness. In this way they *by superposition* can be compared with one another and with the types of the human form considered ideal, or with the types obtained from the anthropometric averages. From the superposition result deviations by excess or deficiency that are also measurable.

For didactic purposes, in our clinic we make use of a screen on which is designed indelibly the front and profile contours of a male and a female human form held as proximate to the ideal. Over them is drawn with chalk the contour of the subject, and the zones of excess are coloured in blue and those of deficiency in red.

The ideal type of the human body in its metric expressions and lines, as well as the valuation of the deviations from the ideal type and the classification of these errors of development in categories or morphological types, are arguments which would deserve special attention.

As is seen, all the measurements indicated differ from those systematically taken by anatomists and anthropologists. It will be asked me why I have not kept to these, and the reason is as follows: the scope which I proposed to myself required a special method, and this could be only that suggested by the fundamental laws of modern morphology. Further, my method is the product of long and repeated proofs made according to the criteria of clinical physio-pathology, and for this, so far as I know, there are no precedents.[1] And, as it happens that in the study of a new question one grasps first of all the main lines, and then one approaches the particulars, so in this study of the measurements of the human body for recognizing the state of organization—or, in other words, the morphological type—I have had to gather information first of all from the fundamental lines, and then gradually from the others.

I have said that my observations have been in thousands, but if I included all those which I made before inventing the method of measurement, and others which I daily discarded because they did not satisfy in every way the rigour necessary in similar researches, their amount would be enormous.

Besides, I must declare that many of the insufficient or incomplete observations have served to strengthen my conviction with regard to some points of the argument; for if from the anthropometric side I wished to do better, from the clinical side I saw a complex of phenomena that the presumed morphological conception of the individual had presented to me.

Meditating every day on the results of the measurements in relationship with the physio-pathological state of the individuals, I sought for the characteristics for classifying the morphological types. The tendency which I acquired owing to the classical studies in the early days of my researches was in open contradiction to the principles that I ultimately embraced. I thought that I had to find a pure physiological type and distinct pathological types.

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[1] Among the authors I have consulted, I wish to record here Liharzik (*Das Gesetz des menschlichen Wachsthums*, etc., Wien, 1858), who, though he has followed a method of measurement which applied to the new-born infant and then to the other periods of life, had the scope of verifying the law according to which the growth of organisms takes place, has reached results, as regards the development of the thorax, which long before now ought to have encouraged pathologists to take up this kind of research. His method, besides, though it was founded upon geometrical data, has not been adopted, so far as I know, by physiologists or anthropologists. And I believe, like the others, it is impracticable; for it was invented with the object of discovering in the individual the *type*, while he can offer us only a *variation*, which for us represents the morbidity that we are in search of.

But the natural fact of the organization corrected me, recalled me to the principles of morphology which I had unconsciously deserted, and I became aware that the morphological type in the ordinary sense—that which would represent the normal in all, and would represent itself in the majority of individuals—does not exist. *The human morphological type, like the morphological type of the races, is a conception, while the morphological type of the individual is a reality.*

From the numerous facts we can argue the morphological attributes that must be found in a perfect type; therefore, we can construct an ideal type. But when one meets with it, or with a type which resembles it more than any other, one can consider it rare, just as perfection is generally rare, and as an example of perfection in the midst of the multitude of the less perfect is an exception to the rule. The reason of this is in what I have said previously, and which it is unnecessary here to repeat.

For this I shall describe the ideal morphological type, but I shall also show the variants which are met with in practice, revealing their particular expression. And I shall endeavour, so far as the nature of the facts will permit, to distinguish in the infinite series of the variations certain groups which experience has indicated as representing definite morbidities.

The Ideal Type.

In the ideal type the following fundamental relationships are found:

1. *The stature equal to the great aperture.*
2. *The thoracic circumference equal to half the stature.*
3. *The length of the sternum equal to a fifth of the thoracic circumference.*
4. *The length of the abdomen equal to two-fifths of the thoracic*

circumference—one-fifth from the base of the xiphoid apophysis to the umbilicus, one-fifth from the umbilicus to the pubis.

5. *The bi-iliac diameter equal to four-fifths of the abdominal length.*

Now I shall give the measurements of a man and of a woman who approach the ideal type, as can be proved by comparing the figures with those given in the following table, in which are expressed the relationships of development of the thorax and of the abdomen with different skeletal heights.

To the name of each measurement I add between brackets the abbreviation that will be used in this book :

	Man. Centimetres.	Woman. Centimetres.
Stature (S.)	172	160
Great aperture (Ga.)	172	160
Thoracic circumference (Thc.)	86·3	79·5
Sternal length (Stl.)	17	16
Abdominal length (Abl.)	32·3 { Xu 16·3 Up 16	30 { 15 15
Bi-iliac diameter (Biil)	26	25·3

If one compare these measurements with those special to the ideal type, one will find some differences, though slight, as regards the relationships of the abdominal cavity and the thorax. And if one then verify, as I have done myself, that the above-mentioned measures appertain to persons endowed with excellent constitutions, healthy and resistant, one will understand the justice of the formula attributed to the ideal type.

Studying many cases, one sees that the differences which are noted between the two sexes are in reality inherent to morphological differences ; therefore some attributes appertaining to the female sex in the male express a special morbidity ; and when in females the same attributes manifest themselves in a less degree, the less the relative morbidities declare themselves.

To these data I here add some very important results of the researches made in my institute by my assistant, Dr. Messedaglia, aided by Dr. Vainanidis—researches suggested by me for controlling my morphological doctrine.[1]

These researches had for their special aim the following points :

1. To investigate whether a relationship exists between the degree of development of certain abdominal viscera and the individual stature.

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[1] *Cf. Rivista medica di Scienze mediche,* December 13, 1901.

TABLE II.

RELATIONS OF DEVELOPMENT OF THE THORAX AND OF THE ABDOMEN WITH DIFFERENT SKELETAL HEIGHTS.

Skeletal Height.	Thoracic Circumference ($=\frac{1}{2}$ Height).	Length of the Sternum ($=\frac{1}{5}$ Thoracic Circumference).	Length of the Abdomen ($=\frac{2}{5}$ Thoracic Circumference).	Bi-iliac Diameter ($=\frac{4}{5}$ Abdominal Length).
Metres.	Centimetres.	Centimetres.	Centimetres.	Centimetres.
1·00	50·0	10·0	20·0	16·0
1·05	52·0	10·5	21·0	16·8
1·06	53·0	10·6	21·2	17·0
1·07	53·5	10·7	21·4	17·1
1·08	54·0	10·8	21·6	17·2
1·09	54·5	10·9	21·8	17·3
1·10	55·0	11·0	22·0	17·6
1·11	55·5	11·1	22·2	17·8
1·12	56·0	11·2	22·4	18·0
1·13	56·5	11·3	22·6	18·1
1·14	57·0	11·4	22·8	18·2
1·15	57·5	11·5	23·0	18·4
1·16	58·0	11·6	23·2	18·5
1·17	58·5	11·7	23·4	18·6
1·18	59·0	11·8	23·6	18·8
1·19	59·5	11·9	23·8	19·0
1·20	60·0	12·0	24·0	19·1
1·21	60·5	12·1	24·2	19·2
1·22	60·5	12·2	24·4	19·3
1·23	61·5	12·3	24·6	19·6
1·24	62·0	12·4	24·8	19·7
1·25	62·5	12·5	25·0	20·0
1·26	63·0	12·6	25·2	20·1
1·27	63·5	12·7	25·4	20·2
1·28	64·0	12·8	25·6	20·4
1·29	64·5	12·9	25·8	20·5
1·30	65·0	13·0	26·0	20·7
1·31	65·5	13·1	26·2	20·8
1·32	66·0	13·2	26·4	20·9
1·33	66·5	13·3	26·6	21·2
1·34	67·0	13·4	26·8	21·4
1·35	67·5	13·5	27·0	21·6
1·36	68·0	13·6	27·2	21·7
1·37	68·5	13·7	27·4	21·8
1·38	69·0	13·8	27·6	22·0
1·39	69·5	13·9	27·8	22·1
1·40	70·0	14·0	28·0	22·4
1·41	70·5	14·1	28·2	22·5
1·42	71·0	14·2	28·4	22·6
1·43	71·5	14·3	28·6	22·7
1·44	72·0	14·4	28·8	22·8
1·45	72·5	14·5	29·0	23·0
1·46	73·0	14·6	29·2	23·1
1·47	73·5	14·7	29·4	23·2
1·48	74·0	14·8	29·6	23·6
1·49	74·5	14·9	29·8	23·7
1·50	75·0	15·0	30·0	24·0
1·51	75·5	15·1	30·2	24·1
1·52	76·0	15·2	30·4	24·2
1·53	76·5	15·3	30·6	24·4
1·54	77·0	15·4	30·8	24·5
1·55	77·5	15·5	31·0	24·7

TABLE II.—*Continued.*

Skeletal Height.	Thoracic Circumference (=½ Height).	Length of the Sternum (=⅕ Thoracic Circumference).	Length of the Abdomen (=⅖ Thoracic Circumference).	Bi-iliac Diameter (=⅘ Abdominal Length)
Metres.	Centimetres.	Centimetres.	Centimetres.	Centimetres.
1·56	78·0	15·6	31.2	24·9
1·57	78·5	15·7	31·4	25·0
1·58	79·0	15·8	31·6	25·2
1·59	79·5	15·9	31·8	25·3
1·60	80·0	16·0	32·0	25·6
1·61	80·5	16·1	32·2	25·7
1·62	81·0	16·2	32·4	25·9
1·63	81·5	16·3	32·6	26·0
1·64	82·0	16·4	32·8	26·2
1·65	82·5	16·5	33·0	26·4
1·66	83·0	16·6	33·2	26·5
1·67	83·5	16·7	33·4	26·7
1·68	84·0	16·8	33·6	26·8
1·69	84·5	16·9	33·8	27·0
1·70	85·0	17·0	34·0	27·2
1·71	85·5	17·1	34·2	27·3
1·72	86·0	17·2	34·4	27·5
1·73	86·5	17·3	34·6	27·6
1·74	87·0	17·4	34·8	27·8
1·75	87·5	17·5	35·0	28·0
1·76	88·0	17·6	35·2	28·1
1·77	88·5	17·7	35·4	28·0
1·78	89·0	17·8	35·6	28·4
1·79	89·5	17·9	35·8	28·6
1·80	90·0	18·0	36·0	28·8
1·81	90·5	18·1	36·2	28·9
1·82	91·0	18·2	36·4	29·1
1·83	91·5	18·3	36·6	29·2
1·84	92·0	18·4	36·8	29·4
1·85	92·5	18·5	37·0	29·6
1·86	93·0	18·6	37·2	29·7
1·87	93·5	18·7	37·4	29·9
1·88	94·0	18·8	37·6	30·0
1·89	94·5	18·9	37·8	30·2
1·90	95·0	19·0	38·0	30·4
1·91	95·5	19·1	38·2	30·5
1·92	96·0	19·2	38·4	30·7
1·93	96·5	19·3	38·6	30·8
1·94	97·0	19·4	38·8	30·1
1·95	97·5	19·5	39·0	31·2
1·96	98·0	19·6	39·2	31·3
1·97	98·5	19·7	39·4	31·5
1·98	99·0	19·8	39·6	31·7
1·99	99·5	19·9	39·8	31·8
2·00	100·0	20·0	40·0	31·2

NOTE.—The measures relative to the biliac diameter, save a few, will be found not very exact, because in the computation the millimetre's fractions were neglected. I have omitted the *transverse diameter*, because, admitting that it is equal to, less, or greater, than the skeletal height, it does not enter into the calculation which has to be made with the other figures included in the table, though it has in every case its signification, as will be seen in its place. I have also omitted the data concerning the *xipho-umbilical* and *umbilico-pubic lines*, because in the ideal type they are equal to one another.

2. To discover the relationship which passes between the external measurements of the abdomen, and the development of the principal viscera in it contained.

They dealt, in other words, with seeing if the external dimensions of the abdomen are truly in relationship with the development of its organs in such a way that, for example, to a large belly must correspond big viscera, and *vice versa.* With regard to the first point, the researches which we proposed to make were not in substance new. Thus, it is known that the various workers whose names will be mentioned presently, and others in olden times, sought for the relationship existing between the stature and the length of the intestinal tract.

The necropsies performed from February to December, 1900, were seventy-seven. Of these, thirty-two were performed at Padua, part in the Institute of Normal Anatomy, part in that of Pathological Anatomy, and forty-five in the post-mortem room of the Civil Hospital, Venice, kindly placed at our disposal.

For a research such as ours the data obtained from seventy-seven cases would certainly represent a material of the first order. But, unfortunately, for the reasons which we shall give presently, we can take into consideration for our present study only a very small number of the cases.

It is readily understood that, for arriving at definite conclusions, a work like this must be based on individuals who during life have not met with causes which would have produced in their organism neither a condition of denutrition or profound alterations of the viscera. That is to say, normal or almost normal bodies which are rarely found on the anatomical table are necessary.

There are, it is true, those dead from trauma, suicides, the drowned (frequent in Venice), etc., who from our point of view represent a select material, but it happened, as a rule, that the necropsy could not be made according to a pre-established plan, for these cadavers were sectioned, as a rule, in the presence of the legal authority, who by law could dispose of them. Thus at Padua and Venice we were unable to make use of several bodies of suicides. Nevertheless, some ot the cases selected appertained to this category, and were left untouched owing to the fact that the external lesions were undoubtedly the cause of death.

There were also cases of sudden death (cardiac paralysis, etc.) and after a few days' illness. But much more frequently they were bodies emaciated and altered in their viscera, which therefore presented material unsuitable for our purpose.

Having made the necessary elimination, the cases selected of subjects in a good state of nutrition, and comparatively free from notable visceral pathological conditions, were twelve only.

The remaining sixty-five had to be set aside, some owing to death from phthisis, others from senile marasmus, others from chronic disease with consecutive cachexia, others from very grave hepatic alterations, and so on.

The twelve cases are tabulated in Table III., p. 134. Here we wish to say briefly that, if they represent a scarce material, they nevertheless constitute a group of individuality sufficiently homogeneous. It deals, in fact, with individuals, all of the male sex and of adult age, who belonged to the same district (Veneto), lived in similar conditions of life (workmen), and were endowed with good nutrition.

A scarce material, then, if one wish, but good, which certainly was not that of several authors who, occupying themselves with the determination of the weight and length of the viscera, made use of all the bodies indifferently which they found on the anatomical table. Other authors, however, took the precaution of making a rigorous selection.

The external measurements made on the cadavers have been given already. Besides these, the weight of the brain and the diameters and weight of the head were also taken.

The *corporeal weights* of all the bodies examined at Padua were registered. In those examined at Venice this was impossible, not having a weighing-machine at one's disposal. *The state of nutrition* was always noted.

With regard to the abdominal viscera, one took into consideration the weight (in grammes) and capacity (in cubic centimetres) of the liver; the weight and length (in centimetres) of the stomach; the weight of the intestines as a whole, and of its large and small divisions.

The liver was weighed deprived of its ligaments, and with the gall-bladder empty.

The stomach was removed at 2 centimetres above the cardiac orifice, and at 1·5 centimetres beyond the pyloric ring, and its capacity was valued as follows:

It was carefully emptied of its contents without subjecting it to excessive pressure, then the pyloric end was tied with a string ligature. Into the cardiac end was inserted and then tied the stem of a Y-shaped glass tube.

One branch of this tube was connected by means of rubber tubing with a water manometer. The other branch, also by means of rubber tubing, was connected with a short glass tube, which passed through a rubber stopper into an empty bottle holding 5 litres. The stopper was also traversed by another tube, connected with a recipient full of water, and provided with a tap placed at a higher level than that at which the bottle, stomach, and manometer were.

Before proceeding to the determination the tap was opened in order to see that the apparatus was in perfect working order. The water as it entered the bottle expelled from it a corresponding quantity of air, which passed through the stem of the Y-tube and dilated the stomach.

At the beginning of the operation the water of the manometer always rose from 2 to 3 millimetres in the free branch, subsequently keeping this position. When the level in this branch showed a tendency to rise further, the tap was closed. The quantity of water which entered the bottle, measured in the graduated tube, represented the capacity of the stomach in cubic centimetres.

In some cases the stomach, tied at the pylorus, was placed in a vessel full of water, holding the cardiac orifice open at the level of the water.

In this way the water poured gently into the stomach. When it was full, but not distended (this was prevented by the pressure of water being equal within and outside the stomach), the water began to issue from the cardia. At this moment the stomach was removed from the vessel, and the water contained in it was measured, and thus indicated its capacity in cubic centimetres.

The weight of the stomach was determined as follows : Having opened the stomach, it was washed carefully, and the ligaments were cut off close to its walls. It was then left to dry between two napkins (avoiding desiccation), and weighed.

The length of the intestine, after the whole of it was removed, was taken with a metallic metric measure, measuring on a table the small intestine from the beginning of the duodenum (at 1·5 centimetres from the pylorus) to the end of the ileum (iliocæcal valve), the large intestine from the beginning of the cæcum to the end of the sigmoid flexure, corresponding to the sacro-vertebral promontory

Naturally, the greatest care was taken in detaching the intestine from the mesentery, and to avoid stretching during the measurement.

The weight of the intestine, having separated the large from the small bowel, was taken after cleaning it externally, and then emptying, opening, washing, and drying it, while the walls were well distended.

It is hardly necessary to state that in all these researches the greatest precautions were taken in order that the results should be as reliable as possible. It must be mentioned that the data relative to the gastric capacity are not to be interpreted too rigorously. The expression of the capacity—in fact, *what it really was in the case under examination*—one understands, owing to reasons of direct evidence (state of the stomach walls, etc.), cannot always be obtained with exactness. Having used every precaution, however, one can say that the figures, if not taken too literally, furnish indications very approximate to exactness.

In Table III. are given the numerical data that most interest us of the twelve cases, arranged according to the stature from minimum to maximum.

It would have been desirable to have given them integrally, with all the measurements taken, and the individual tables, but reasons of space prevent it. We shall now give the necroscopic findings and eventual observations.

Necroscopic Findings—Observations.

I. Stephen G., Civil Hospital, Venice, November 24, 1900. Died five hours after a very severe trauma of lower belly.

Necroscopy.—General nutrition excellent. All the viscera healthy, but profoundly anæmic. Fracture of symphysis pubis and of lower third of left leg, with vast and deep lacerations. Rupture of bladder.

The measurement of the bi-iliac diameter is only approximate, owing to the fracture of the symphysis with separation of its halves.

II. James B., Civil Hospital, Venice, October 21, 1900. Rapid death following profuse cerebral hæmorrhage.

TABLE III.

Progressive Number.	Age.	Stature.	ABDOMEN.							LIVER.	STOMACH.		INTESTINE.					
													Total.		*Small.*		*Large.*	
			H.C.	A.P.D.	T.D.	X.P.	X.U.	U.P.	B.I.	Weight.	Weight.	Capacity.	Weight.	Length.	Weight.	Length.	Weight.	Length.
I.	52	163·6	84·5	18·3	29·6	34·0	19·5	14·5	25·0	2020	96	2000	392	850	273	715	119	135
II. . .	67	164·5	86·2	—	27·2	35·6	20·0	15·6	27·2	1460	136	1900	590	860	392	680	198	180
III. . .	60	165·3	87·4	21·3	28·3	33·5	19·2	14·3	27·1	1590	108	3200	531	875	315	750	216	125
IV. . .	54	167·8	73·5	—	25·8	34·0	17·0	17·0	26·5	1310	100	720	373	770	259	610	114	160
V. . .	37	168·7	87·5	18·5	30·2	39·0	22·5	16·5	24·8	1770	100	1830	415	905	235	735	180	170
VI. . .	57	168·8	83·2	18·7	27·8	35·0	19·1	15·9	23·4	1780	120	2000	456	940	294	765	162	175
VII. . .	56	170·2	94·0	21·0	31·9	31·2	17·5	13·7	29·6	2070	140	3340	640	1190	420	985	220	205
VIII. . .	54	170·7	85·0	—	27·8	36·5	19·5	17·0	28·0	1350	112	2250	548	1090	308	860	240	230
IX. . .	62	172·2	97·0	—	29·5	39·0	22·5	16·5	27·5	2030	136	2640	558	970	336	770	222	200
X. . .	57	173·0	90·0	—	26·3	35·0	19·2	15·8	24·0	1350	70	2820	370	925	220	805	150	120
XI. . .	46	175·0	93·0	23·3	30·0	37·2	19·5	17·7	28·0	2100	96	2400	502	695	340	585	162	110
XII. . .	57	179·8	88·5	21·2	30·5	38·5	21·0	17·5	26·7	2540	102	1500	492	1015	308	845	184	170

NOTE.—H.C., Hypochondriac circumference; A.P.D., antero-posterior hypochondriac diameter; T.D., transverse hypochondriac diameter; X.P., xypho-pubic line; X.U., xypho-umbilical line; U.P., umbilico-pubic line; B.I., bi-iliac diameter.

Necroscopy.—General condition very good. Large hæmorrhage in right lateral ventricle of brain, invading also the third ventricle and left lateral ventricle. Atheromatous ulcer on intima of aorta ; hypertrophy of myocardium ; chronic catarrh of stomach. Spleen with copious recent hæmorrhages. Kidneys congested.

III. Noel A., Civil Hospital, Venice, November 16, 1900. Death from acute alcoholic poisoning.

Necroscopy.—General nutrition very good ; strong congestion of the brain and meninges. Slight hypertrophy of heart ; central atheroma. Lungs œdematous ; on left scarce pleuritic effusion.

IV. Angel M., Civil Hospital, Venice, October 18, 1900. Death through trauma of head.

Necroscopy.—General nutrition good. Fracture of left temporal bone ; rupture of right middle meningeal artery ; hæmatoma in right middle cerebral fossa. Hyperæmia of cerebral substance. Hæmorrhage corresponding to left corpus striatum. Old pleuritic adhesions bilaterally. Stomach contracted.

V. Victor F., Civil Hospital, Venice, November 30, 1900. Suicide by firearms.

Necroscopy.—General nutrition excellent. The left parietal, palatine, superior maxillary, and ethmoid bones were fractured by a revolver bullet, which from the oral cavity struck the left parietal, raising a splinter, then returning into cerebral mass of left parietal lobe. Incipient central atheroma. Lungs and pleura normal. Liver and spleen undergoing initial putrefaction. Kidneys congested.

VI. Lewis N., Civil Hospital, Venice, December 19, 1900. Sudden death in street.

Necroscopy.—General nutrition good. Brain anæmic. Hypertrophy of left ventricle of h art. Atheroma and dilatation of aorta. Right pulmonary emphysema. Atelectasis of left lung ; on this side many old pleuritic adhesions. Liver and stomach normal. Perisplenitis and notable chronic swelling of spleen. Recent hæmorrhage in small intestine. Renal arterio-sclerosis.

VII. James B., Civil Hospital, Venice, November 18, 1900. Drowned.

Necroscopy. — General nutrition excellent. Hyperæmia of meninges and brain. Slight hypertrophy of heart. Hyperæmia of pleura. Marked pulmonary œdema. All the abdominal viscera normal.

VIII. Anthony M., Civil Hospital, Venice, October 24, 1900. Destroyed himself by jumping from the third floor into the street.

Necroscopy.—General nutrition very good. Cerebral hyperæmia. Multiple hæmorrhage corresponding to the lumbar enlargement of the medulla. Right pleuritic adhesions. Liver with some areas of fatty degeneration. Spleen and kidneys normal. Multiple lacerations of psoas muscles.

IX. Saviour S., Civil Hospital, Venice, October 28, 1900.

Necroscopy.—General nutrition excellent. Brain congested. Slight œdema of pulmonary bases. Total hypertrophy of heart. Aortic atheroma. Liver congested. Spleen cardiac. Kidneys hyperæmic.

X. John M., Royal Institute of Pathological Anatomy, Padua, May 6, 1900.

Necroscopy.—General nutrition good. Corporeal weight, 65 kilogrammes. Meninges injected; subarachnoid œdema; total hypertrophy of heart; fatty degeneration of myocardium. Aortic atheroma. Punctiform pleuritic hæmorrhages, and old and recent pleuritic adhesions. Acute œdema of lungs. Acute gastric catarrh. Acute catarrhal duodenitis. Larynx: neoplastic ulcer which implicated left half of thyroid cartilage, and extended to base of epiglottis. The fungoid mass and purulent material of ulcer almost completely occluded the laryngeal lumen. Death occurred through suffocation.

XI. Mario F., Civil Hospital, Venice, November 17, 1900. Death following very acute gangrenous appendicitis.

Necroscopy.—General nutrition excellent; form athletic. Hyperæmia of meninges and brain. Heart brown; pericardiac adhesions. Slight central atheroma. Acute œdema of lungs. Gangrene of vermiform appendix. Fibrino-purulent peritonitis. Mucosæ of stomach and intestine normal; serosa covered with exudate readily detachable, and which was carefully removed before proceeding to drying and subsequent weighing of intestine.

XII. John P., Civil Hospital, Venice, December 5, 1900.

Necroscopy.—General nutrition very good. Brain and meninges hyperæmic. Slight hypertrophy of right ventricle of heart. Lungs: fibrinous pneumonia in second stage, of lower and upper lobes of right, and of lower lobe of left. Kidneys: slight acute parenchymatous nephritis. All the other abdominal organs normal.

We deem it advisable to compare our results with those of other authors in the following tables :

TABLE IV.

WEIGHT OF THE LIVER.

Authors.	Age.	Sex.	Weight.
Beneke	24–31	—	1463
,,	47–71	—	1591
Birch-Hirschfeld	19–60	—	1624
E. Bischoff	33	♂	1596 (with the bile)
Blosfeld	—	♂	1617
,,	—	♀	1570
Debierre	—	—	2000
Dieberg	—	—	1692
Dursy	42	♂	1981
Frerichs	—	♂	800–2100
Geist	60–70	♂	1257
,,	,,	♀	1220·5
Gluge	29	♂	1145
Gocke	—	♂	1691
,,	—	♀	1482
Henle	—	—	820–2100
Junker	—	♂	1693
,,	—	♀	1451
Krause	—	♂	1871
Messedaglia and *Vainanidis*	37–67	♂	1780·83
Orth	—	—	2000–3000
Sappey	—	—	1451
Schwann	42	♂	1572
Testut	—	—	1450–1500
Tillaux	—	—	2000
Vierordt	25	♂	1819
,,	,,	♀	1664

In our twelve cases, with a mean of 1,780·83 grammes, one has a minimum of 1,310 grammes (Case IV.) and a maximum of 2,540 grammes (Case XII.). According to the pathologists, one has a minimum of 786 grammes (seventy-eight years, *senile marasmus*) and a maximum of 3,160 grammes (thirty-two years, *pulmonary tuberculosis, amyloid degeneration of liver*) for men ; and for women, a minimum of 878 grammes (eighty-three years, *senile marasmus, acute nephritis*) and a maximum of 1,840 grammes (nineteen years, *pulmonary phthisis*).

These oscillations are, as is seen, very wide, and in the pathological cases easily explainable. They exist also in normal individuals, as is shown clearly, if not by our table, based on a few cases where the difference is very notable, by Junker's tables, constructed on ninety-nine cases for men, and on forty for women. Here, in fact, we find a minimum of 870 grammes and a maximum of 2,550 grammes for men, and a minimum of 760 grammes and a maximum of 1,150 grammes for women.

We shall now give some data relative to the *gastric capacity* expressed in cubic centimetres :

Beneke	2677
Brinton	3130
Ewald	250–1680
Fermi and Repetto	1300–4350 (men)
,, ,,	1550–2730 (women)
Luschka	2500–2600 (men)
,,	1750 (women)
,, and Schüren	3430
Messedaglia and *Vainanidis*	2216 (men)

We, with a mean of 2,216 c.c., have a minimum of 720 (Case IV.) and a maximum of 3,340 (Case VII.). In the data of the other authors, we find for men a minimum of 500 (eighty-four years, *pyloric neoplasm*) and a maximum of 3,200 (sixty-nine years, *hypertrophic hepatic cirrhosis*), and for women a minimum of 470 (thirty-six years, *pulmonary phthisis*) and a maximum of 2,460 (eighty-nine years, *diffuse general atheroma, senile marasmus*).

With regard to the *weight of the stomach*—and the same can be said for that of the intestine—we shall see immediately that our figures are much lower than those of the other authors, owing to the *different and more rigorous technique* adopted by us before proceeding to the weight :

	Grammes.
Bischoff	183 (33 years).
Fermi and Repetto	166–290
Huschke	170–232 (men)
Messedaglia and *Vainanidis*	100·50 ,,
Theile	202 (42 years).

With an average of 100· 50 grammes in our cases one has a minimum of 70 grammes (Case X.) and a maximum of 140

(Case VII.). And according to the pathologists: for men, one has a minimum of 64 grammes (case already referred to as the maximum of the liver), a maximum of 245 grammes (forty-eight years, *pulmonary phthisis, catarrhal gastritis*). For women, one has a minimum of 64 grammes (*pulmonary phthisis*), a maximum of 270 grammes (seventy years, *diffuse general atheroma*).

We now come to the *length of the intestines* expressed in centimetres.

TABLE V.

Authors.	Age.	Sex.	Total.	Small.	Large.
Beck	—	♂	—	—	137
Beneke	—	—	798	646	152
,, ...	44–71	—	892	718	174
Cruveilhier	—	—	430–970	300–800	130–170
Debierre	—	—	930–970	800	130–170
Frolowsky	—	—	750	600	150
Gluge	20	♂	997	769	228
Hoffmann	—	—	800–900	700–750	120–150
Luschka	—	—	—	785	157–220
Krause	—	—	800	—	—
Meckel	—	♂	758	564	—
,, ...	—	♀	628	—	—
Messedaglia and *Vainanidis*	37–67	♂	923	760	163
Rolssen	—	♂	841	—	—
,, ...	—	♀	781	—	—
Sappey	—	—	1045	880	165
Schwann	20	♂	1080	—	—
,, ...	23	♂	1000	—	—
,, ...	25	♂	1040	—	—
,, ...	42	♂	1150	—	—
,, ...	53	♀	965	—	—
,, ...	56	♀	1085	—	—
Tarenetzky	—	—	799	641	158
Testut	—	—	—	600–800	140–170
Tillaux	—	—	—	800	—

With an average of 923 centimetres in our selected cases, we have a minimum of 695 centimetres (Case XI.) and a maximum of 1,190 centimetres (Case VII.). In the pathologists' cases we have, for men, a minimum of 520 centimetres (sixty-four years, hepatic abscess), and a maximum of 1,125 centimetres (seventy years, *diffuse general atheroma, chronic hæmorrhagic gastro-enteritis*), and for women a minimum of 415 centimetres (thirty-three years, *hepatic cirrhosis*) and a maximum of 905 centimetres (seventy-three years, *acute nephritis, fatty degeneration of the heart*).

This is for the total length. We find similar oscillations for the small and large intestines, but for reasons of space we believe it opportune not to refer to them.

As for the weight of the stomach, we have also few data for the *weight of the intestines*, concerning which we have already mentioned that our figures differ much from those of the other authors, owing chiefly to the drying practised by us.

TABLE VI.

Authors.	Age.	Sex.	Total.	Small.	Large.
Bischoff	24	♀	1015	564	451
,, ...	23	—	1083	713	370
Huschke	—	♂	1120	682	438
Messedaglia and *Vainanidis*	37–67	♂	488·92	308·33	180·58
Theile	42	—	1260	780	480

For the intestine, considered as a whole, with an average of 488·92 grammes, we have a minimum of 370 grammes (Case X.) and a maximum of 640 grammes (Case VII.).

And, in the pathologists' cases, we have for men a minimum of 287 grammes (case already referred to as the minimum of the gastric capacity) and a maximum of 937 grammes (seventy years already referred to as the maximum of the intestinal length), and for women a minimum of 232 grammes (thirty-three years, *pulmonary phthisis*) and a maximum of 623 grammes (fifty-one years, *lobar pneumonia, biliary calculi*).

Here, also, for the small and large intestines, the foregoing remarks are applicable.

We shall now consider the relationship between the individual stature and the development of the viscera examined by us.

And we shall begin with the most simple case—namely, that in which one places in relation two measurements of the same kind—the stature and the length of the intestines (total length, that of the small and that of the large), both expressed in centimetres. It is sufficient, following the usual rule, to make all the statures equal 100, and to reduce proportionately the values of the intestine.

Even in olden times, as we have said, they wished to place the length of the intestine in relationship with the stature. Before proceeding further, it seems to me opportune to quote the following passage from the *Anatomia ad sanguinis circulationem reformata* of Thomas Bartholin, in which the data that relate to our subject are given:

"*Longitudo* (*intestinorum*)," writes the illustrious Danish anatomist, "*ut plurimum sexies plus minus superat longitudinem hominis cuius sunt, sed palmo uno et semisse deficiente, teste Picolhomineo: septies numerant Laurentius, Paræus et Riolanus; et ante hos Celsus qui tamen ab œsophago mensuram exordiebatur. Hippocrates cubitos fere tredecim, vel non minus duodecim ponit: at statura iusta huminis vix superat cubitos tres cum dimidio; Fluddius in corpore quodam ulnæ unius cum dimidio, intestina ulnarum novem tantum invenit; unde certa mensura definiri nequit.*"

Although the comparison of the individual figures interests us above all, we shall give here, together with our averages of the relative intestinal lengths, the analogous figures of other authors taken from *Vierordt*, and reducing all to 100.

TABLE VII.

Authors.	Sex.	Total Length.	Observations.
Beneckc	—	479	Without duodenum.
Cruvcilhier	—	600	—
Husehke	—	600–700	—
Meckel	♂	486	—
,, ...	♀	432	—
Messedaglia and *Vainanidis*	♂	543	*Small*, 446; *large*, 97; *without rectum*.
Rolssen	♂	500	Without duodenum and rectum.
,, ...	♀	530	—
Sappey	—	600–700	With stomach and œsophagus.
Spigclius	—	600	—

In the following table, with the stature equalling 100, is given the length of the intestines in our twelve cases, arranged (as in Table IX.) according to increasing personal height.

TABLE VIII.

Progressive Number.	Total.	Small.	Large.
I. ..	520	437	83
II. ..	523	413	109
III. ..	529	454	75
IV. ..	459	364	95
V. ..	536	436	101
VI. ..	557	453	104
VII. ..	699	578	120
VIII. ..	639	504	135
IX. ..	563	447	116
X. ..	535	465	69
XI. ..	397	334	63
XII. ..	565	470	95

A glance at this table dispenses us from long comments. One sees immediately, in fact, that the length of the intestines in our cases has no constant relationship with the stature. A similar result was obtained comparing twelve individuals of the male sex (of the above pathologists) whose stature was almost equal to that of the twelve selected.

TABLE IX.

Stature.	Age.	Necroscopic Diagnosis.	Real Length (Total Intestines).	Length = 100 (Total Intestines).
163·0	64	Laennec's cirrhosis—lobar pneumonia	645	396
163·8	50	Purulent pleuritis — acute nephritis	870	531
165·0	32	Pulmonary phthisis	795	482
165·3	27	,, ,, ...	695	420
166·8	39	Hypertrophic hepatic cirrhosis—chronic enteritis	745	447
168·8	55	Pulmonary phthisis	820	486
170·0	30	Hepatic abscess—right purulent pleuritis	560	329
171·6	65	Fibrino-purulent peritonitis ..	622	362
172·7	30	Pulmonary phthisis—tubercular enteritis	695	402
175·0	69	Hypertrophic hepatic cirrhosis ..	650	371
178·4	44	Pulmonary phthisis — acute nephritis	786	456
180·4	27	Fibrino-purulent peritonitis ..	575	319

We shall now put in relationship the other measurements —that is to say, the weight of the liver, the capacity of the stomach, the weight of the intestines, with the stature, supposed, as above, equalling 100.

Here the method of calculation is not so simple, inasmuch as one has to deal no longer with comparing a measure of length with a measure of length, but measurements of different nature with one another.

Following the example given by Livi for the calculation of his "ponderal index," we proceed as follows :

Having admitted that a line, such as the stature, can be compared only with a line, it will be necessary to reduce the weight of the organs examined to a linear measure.

It is necessary, therefore, to find the side of the cube indicating the respective *volume* of the viscera.

Here it must be mentioned that, according to a known formula—

$$P = d\ V$$

—that is to say, the weight of a body (P) is equal to the product of its density (d) by its volume (V), and consequently—

$$V = \frac{P}{d}$$

—that is, the volume is equal to the quotient of the weight divided by the density. It is understood that, the weight being expressed in grammes, the volume is expressed in cubic centimetres, and the side in centimetres.

In our case it was necessary to know the density of the organs examined ; now the density of the liver is known to be 1·0721 (Krause and Fischer), that of the stomach 1·050 (Davy), that of the intestine 1·041 (Davy).

With regard to the volume of the stomach, its capacity having been known, the calculation was readily made, since $V = C$ (capacity), d being $= I$.

Having found the volume, its cube root was sought ; this expresses in centimetres the side sought.

Making next the proportion (calling the stature S and the side s)—

$$S : s :: 100 : x$$

$$\text{hence } x = \frac{s\ .\ 100}{S},$$

—that is, multiplying by 100 the sides found, and dividing the product by the respective statures, we obtained the sides corresponding to a single stature (= 100); a series of data—in other words, comparable with one another, corresponding to what had been made for the length of the intestine.

This without doubt is a long and tedious procedure, but it at least responds to the laws of mathematics, different from that illogically adopted by Wesener, who, occupying himself with the volume of the lungs and of the liver in different ages, arrived at (with the individual stature = 100) the absolute volume of the organs taken by him into consideration, thus falling into the error of instituting a relationship, comparing measures of different qualities with one another.

In Table X. are given all the sides reduced, with the stature = 100.

TABLE X.

Progressive Number.	Liver (Weight).	Stomach.		Total Intestines (Weight).
		Weight.	Capacity.	
I.	7·550	2·744	7·696	4·441
II.	6·738	3·072	7·530	4·990
III.	6·893	2·826	8·914	4·830
IV.	6·371	2·759	5·341	4·228
V.	7·004	2·744	7·250	4·360
VI.	7·014	2·873	7·459	4·499
VII.	7·315	3·006	8·783	4·994
VIII.	6·325	2·773	7·676	4·729
IX.	7·184	2·934	8·026	4·717
X.	6·241	2·324	8·166	4·092
XI.	7·149	2·570	7·650	4·480
XII.	7·408	2·623	6·367	4·330

By reason of the conclusive figures of this table, it is useless to refer to the volume of the individual viscera, found with the above-mentioned formula and its cube root, or the real absolute side.

Putting into few words what from the examination of the table itself appears clear, and observing that, owing to the smallness of the figures obtained, one must take into consideration also the decimals, we can say that the weight of the liver, the capacity of the stomach, and the complexive weight of the intestines, like the length of the latter, show no relationship with the stature.

Certainly, from such a small number of cases one cannot make many deductions ; we desire to mention only that, analogously to what has been observed concerning the absolute values, these relative values also oscillate within very wide limits.

Messedaglia, desirous of a confirmation, and following the identical process, has found the volume of the liver, the real side of the cube, and the relative, taking a group of twelve individuals (the last) from Table III., and from Junker, who has not neglected to give (an essential thing for us) the stature of each person. The cases which Junker arranged according to age, Messedaglia has arranged according to increasing stature.

TABLE XI.

Stature.	Age.	Weight of Liver.	Side to 100.
147	67	1450	7·522
153	45	870	6·095
157	56	1370	6·912
159	60	2000	7·742
160	54	1650	7·214
162	50	1510	6·918
164	46	1640	7·206
165	64	1500	6·779
167	59	1825	7·149
168	48	1590	6·788
171	55	1350	6·314
173	53	1740	6·793

The results of this calculation for the weight of the liver confirm what we have derived from the examination of our cases.

Consequently, from that little which we have been able to see, one can conclude that the development of the abdominal organs is not in relationship with the development in height of the body. Does there exist, on the contrary, a relationship between the visceral development and the dimensions of the cavities in which the viscera are contained ?

This relates precisely to the quest of the relationship which subsists between the external measurements of the abdomen and the development of its viscera.

Of this relationship we, by reason of the few cases which we were able to make use of for our study, at present possess only the conviction, which I hope will be demonstrated by further investigations.

Messedaglia and Vainanidis being unable, owing to the scarcity of the material, to obtain charts demonstrative at a glance in order to clear up matters, had recourse to a very simple method : they arranged, that is to say, the absolute figures of the weight, capacity, and length of the organs examined in progressive series, commencing with the lowest figure, and ending with the highest, and under each of them wrote the corresponding external measurements of the abdomen (see Table III.).

The weight of the liver and the gastric capacity (it appeared useless to consider the weight of the stomach on account of its numerical expression being so small) were thus compared with the xipho-umbilical line, the transverse hypochondriac diameter, and the hypochondriac circumference, and also with the supra-umbilical surface, obtained by multiplying the xipho-umbilical by the transverse hypochondriac diameter.

The weight and length of the intestine, considered in its totality, were put in relationship with the xipho-pubic line, the umbilico-pubic line, the bi-iliac diameter, and the abdominal surface, obtained by adding together the supra-umbilical surface and the sub-umbilical (product of the umbilico-pubic line by the bi-iliac diameter).

The length of the intestine was then compared with the sub-umbilical surface.

To each table finally were added the averages of the first four cases (corresponding to the lowest numerical expressions of the viscera) and those of the last four (corresponding to the highest).

All these data are collected in the following Tables, XII., XIII., XIV., and XV.

Adding together the weights of the viscera of each case, they obtained the individual *visceral complexive weight,* which was put in relationship with the xipho-pubic line, the bi-iliac diameter, the hypochondriac circumference, the hypochondriac diameter, and the abdominal surface (Table XVI.).

From the examination of these tables we can deduce as follows :

In all, considered in their totality, we see the lowest and the

TABLE XII.

Cases (see Table III.).	IV.	VIII.	X.	II.	III.	V.	VI.	I.	IX.	VII.	XI.	XII.	Averages of Four First.	Averages of Four Last.
Weight of liver . .	1310·0	1350·0	1350·00	1460·0	1590·00	1770·0	1780·00	2020·00	2030·00	2070·00	2100·0	2540·0	1367·50	2185·00
Xipho-umbilical . .	17·0	19·5	19·20	20·0	19·20	22·5	19·10	19·50	19·50	17·50	22·5	21·0	18·98	20·12
Trans. hypochon. d.	25·8	27·8	26·30	27·2	28·30	30·2	27·80	29·50	29·60	31·90	30·0	30·5	26·78	30·47
Hypochon. circ. . .	73·5	85·0	90·00	86·2	87·40	87·5	83·20	97·00	84·50	94·00	93·0	88·5	84·67	93·12
Sup. supra-umb. . .	438·6	542·1	504·96	544·0	543·36	679·5	530·98	577·20	663·75	558·25	585·0	640·5	507·41	611·81

TABLE XIII.

Cases (see Table III.).	IV.	XII.	V.	II.	I.	VI.	VIII.	XI.	IX.	X.	III.	VII.	Averages of Four First.	Averages of Four Last.
Capacity of stomach	720·0	1500·0	1830·0	1900·0	2000·0	2000·00	2250·0	2400·0	2640·00	2820·00	3200·00	3340·00	1487·50	3005·00
Xipho-umbilical . .	17·0	21·0	22·5	20·0	19·5	19·10	19·5	19·5	22·50	17·50	19·20	17·50	20·12	19·17
Trans. hypochon. d.	25·8	30·5	30·2	27·2	29·6	27·80	27·8	30·0	29·50	26·30	28·30	31·90	28·42	29·50
Hypochon. circ. . .	73·5	88·5	87·5	86·2	84·5	38·20	85·0	93·0	97·00	90·00	87·40	94·00	83·92	92·10
Sup. supra-umb. . .	438·6	640·5	679·5	544·0	577·2	530·98	542·1	585·0	663·75	504·96	543·36	558·25	575·65	567·58

TABLE XIV.

Cases (see Table III.).	X.	IV.	I.	V.	VI.	XII.	XI.	III.	VIII.	IX.	II.	VII.	Averages of Four First.	Averages of Four Last.
Weight of intestine . .	370·00	373·0	392·0	415·0	456·00	492·00	502·0	531·00	548·00	558·0	500·00	640·00	337·60	584·00
Xipho-pubic	35·00	34·0	34·0	39·0	35·00	38·50	37·2	33·50	36·50	39·0	35·60	31·20	35·50	35·57
Umbilico-pubic . .	15·80	17·0	14·5	16·5	15·90	17·50	17·7	14·30	17·00	16·5	15·60	13·70	15·95	15·70
Bi-iliac diameter . .	26·00	26·5	25·0	24·8	23·40	26·70	28·0	27·10	28·00	27·5	27·20	29·60	25·57	28·07
Sup. abdominal . .	915·76	889·1	939·7	1088·7	903·03	1107·75	1080·6	930·89	1018·10	1117·5	968·32	963·77	958·31	1016·02

TABLE XV.

Cases (see Table III.).	XI.	IV.	I.	II.	III.	V.	X.	VI.	IX.	XII.	VIII.	VII.	Averages of Four First.	Averages of Four Last.
Length of intestine . .	695·0	770·0	850·0	860·00	875·00	905·0	925·00	940·00	970·00	1015·00	1090·0	1190·00	794·00	1066·00
Xipho-pubic . .	37·2	34·0	34·0	35·60	33·50	39·0	35·00	35·00	39·00	38·50	36·5	31·20	35·20	36·30
Umbilico-pubic . .	17·7	17·0	14·5	15·60	14·30	16·5	15·80	15·90	16·50	17·50	17·0	13·70	16·20	16·17
Bi-iliac diameter . .	28·0	26·5	25·0	27·20	27·10	24·8	26·00	23·40	27·50	26·70	28·0	29·60	26·68	27·95
Sup. sub-umbilic . .	495·6	450·5	362·5	424·32	387·53	409·2	410·80	372·06	453·75	467·26	476·0	405·52	433·20	450·63
Sup. abdominal . .	1080·6	889·1	939·7	968·32	930·89	1088·7	915·76	903·04	1117·50	1107·75	1018·1	963·77	969·40	1051·70

TABLE XVI.

Cases (see Table III.).	IV.	X.	VIII.	II.	III.	V.	VI.	I.	XI.	IX.	VII.	XII.	Averages of Four First.	Averages of Four Last.
Weight of viscera . .	1783·0	1790·00	2010·00	2186·00	2229·00	2285·0	2356·00	2508·0	2698·00	2724·0	2850·00	3144·00	1942·00	2854·00
Xipho-pubic . .	34·0	35·00	36·50	35·60	33·50	39·0	35·00	34·0	37·20	39·0	31·20	38·50	35·27	36·47
Bi-iliac diameter . .	26·5	26·00	28·00	27·20	27·10	24·8	23·40	25·0	28·00	27·5	29·60	26·70	26·92	27·95
Hypochondriac circ.	73·5	90·00	85·00	86·20	87·40	87·5	83·20	84·5	93·00	97·0	94·00	88·50	83·67	93·12
Trans. hypochon. di.	25·8	26·30	27·80	27·20	28·30	30·2	27·80	29·6	30·00	29·5	31·90	30·50	26·77	30·47
Sup. abdominal . .	899·1	915·76	1018·10	968·32	930·89	1088·7	903·04	939·7	1080·60	1117·5	963·77	1107·75	947·82	1067·40

highest figures of the measurements taken, and the products of these obtained (supra- and sub-umbilical surfaces and abdominal surface) united respectively with the lowest and highest figures of the viscera. This, in other words, means that the minor or major degree of visceral development is in direct relationship with the dimensions of the belly.

It is still better proved by the averages of the first four and of the last four cases included in each table.

There are, however, interesting exceptions—thus, for the xipho-umbilical line, and the supra-umbilical surface in the capacity of the stomach (Table XIII.); for the umbilico-pubic in the weight of the intestine (Table XIV.) and in its length (Table XV.). Probably, if one had at one's disposition a larger number of cadavers, even these apparent contradictions would not have occurred. With regard to these, we desire to reveal their importance, in the sense that they tell us clearly it is not one or a few external measurements, but many taken in different directions, which are sufficient to give us a conception of the development of the internal organs. It is obvious, in fact, that (to give an example) an abdomen, which may seem to be small because deficient in length, may very well be in reality large, owing to being very developed, let us suppose, in its transverse diameters.

We shall now consider briefly some individual cases. It is here where we have under our hand the enormous variety of organization of the human body, considered both externally and in the development of its organs. This is the axiom on which is founded the clinical doctrine of our school.

Let us glance at Case IV. : it is that which has the minimum weight of liver, minimum gastric capacity, and minimum complexive weight of the viscera, and barely the second place in the weight and length of the intestines. On the other part it has also the minimum xipho-umbilical line, minimum transverse hypochondriac diameter, minimum hypochondriac circumference, and minimum abdominal surface.

If the xipho-pubic and umbilico-pubic lines and the bi-iliac diameter are not expressed by minimum numbers, they are nevertheless by rather low ones. This case is, therefore, a very good one for our demonstration.

Case VII., on the contrary, is remarkable for the high numerical values of the viscera, and has the minimum xipho-pubic line, with a xipho-umbilical line, which occupies the second place, and with a minimum umbilico-pubic line. *Vice versa,* it has the maximal transverse hypochondriac diameter, the maximal bi-iliac diameter, and the hypochondriac circumference and antero-posterior hypochondriac diameter high. By a law of compensation, this abdomen is excessively developed in breadth, forming consequently a cavity capable of containing a notable visceral mass.

We shall not comment, for the sake of brevity, on the other cases (readily done by analyzing the tables), from which interesting observations could be derived, and which would more clearly show the continuous intervention of the law of compensation.

And also with regard to the organs, many of which even on the same subject are met with unequally developed, we see the same law intervene, and a given organ arrive at a degree of development preponderant in comparison with another—almost as if the former were developed at the expense of the latter.

Thus we find in Case VIII., besides a very notable gastric capacity (2250) and a good weight of the stomach (112), a liver little developed (1350). This case also occupies a high place for the weight (548), and more still for the length (1090) of the intestine.

Although, unfortunately, the number of cadavers which served for this study was scarce, from what we have stated up to now we can affirm that—

The development of the abdominal viscera is not in relationship with the individual corporeal form expressed by the stature, but is, on the contrary, in relationship with the development of the abdomen.

Hence it is that from the study of the external conformation of the belly, considered in all its measurements, otherwise *in its form,* one obtains valuable criteria regarding the degree of development of the viscera contained in it, and therefore regarding their eventual morbidity.

But it will be asked, Why have the measurements of the cranium been neglected ? I can only answer with the following conceptions of Manouvrier, from which it appears that if I had not done so I would have introduced into my calculations terms still extremely uncertain.[1]

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[1] *Recherches d'anatomie comparative et d'anatomie phylosophique sur les caractères du crâne et du cerveau* (see *Archivio per l'antropologia e l'etnologia.* Firenze, 1883, vol. xiii., p. 68).

" Sensation and intelligence are the functions whose intensity does not depend upon the general development of the organism. It is owing to this that the weight of the encephalon and that of the cranium which protects it present variations very independent from the stature.

" The encephalon serves not only the intellectual functions, but likewise motion and nutrition. For this reason its weight does not always measure the intensity of the thought, and it is also necessary to take into consideration the part of development that belongs to other functions which it directs and governs. The weight of the femur and that of the inferior maxilla are the parts of the skeleton most suitable for making this correction. . . . Up to now one can maintain that the weight of the femora is in relationship with the motor regions of the encephalon, and that the weight of the mandible is in strict relationship with the development of the bulb and isthmus.

" Intelligence and sensation not being proportionate to the stature, the parts of the encephalon consecrated to these functions must be more developed—relatively, not only to the other parts of the brain and the other parts of the body, and especially to the apparatus of vegetative life and of locomotion, but also in inverse proportion to the dimensions of the body."

From this it follows that the proportions of the different parts of the encephalon in comparison with one another, and the proportions of the encephalon as a whole in respect of the body, are under the dependence of two formal factors—that is, the development of the sensorio-intellectual functions and the development of the body.

Amadei, at the Third Italian Phreniatric Congress, had already (1881) made known that the augmentation of the encephalic weight with the stature is to be referred probably to the centres destined to nutrition, to the sensations, and the movement contained in the encephalic mass, it having been proved by comparative and human anatomy that the increase of encephalic weight is not in relationship with the increase of the intellectual powers.

Be this as it may, however desirous one may be that the science will succeed in providing us with certain and positive criteria for enabling us to institute morphological relations between the cranium and the parts of the organism which exercise the phenomena of nutrition, of which we specially occupy ourselves, it must be confessed that for the present similar relations cannot be determined.

I deem it more useful instead to occupy myself with some

Generalities on the Morphology of the Vertebral Column.

From the data of the skeletal measurement, we shall be able in the concrete case to form a good idea of the excesses and defects of development of the vertebral column as a whole and in its parts.

I shall begin with giving the result of my observations in the clinical field, which consists in this : Taking the vertebral column as a whole, the error of development in length presents itself as an excess, hardly ever as a defect.

This fact enables us to admit that the *excessively long vertebral column is to be regarded as a persistent embryonic character ;* that which, besides, happens for other parts of the organism—as, for example, the xipho-umbilical line, the liver, thymus gland, etc.

After the second month of intra-uterine life the length of the spine becomes gradually modified, while the lower limbs develop ; at the fifth month of intra-uterine life it has reached three-fifths of the length of the body ; at birth and in the adult it has reached two-fifths.

But it must be equally mentioned that the process of ossification of the column, which does not begin in every spot at the same time and in a uniform mode in all its parts, progresses with extreme slowness, and is not completed, as a rule, till between the twenty-fifth and thirtieth years. Therefore with greater foundation we can admit that *when the spinal column as a whole, or in some of its parts, conserves the above-mentioned embryonic character, it is an indication of existing or of pre-existing morbidity*, according to whether we have to consider individuals in whom the processes of growth and ossification of the column have not been completed, or who have passed beyond the last phases of development. In this latter case the excessive length of the spine or of one of its parts can no longer be considered, rigorously speaking, as an embryonic character, but as a consequence of excessive development of the parts which constitute it—the vertebræ proper and the intervertebral discs.

Besides these considerations, others present themselves which are not of less importance when we regard the vertebral column in its relations with the general state of the individual—that is, with the particular morphological combination. And it is understood that, if the individual bears the morphological characters of the first combination, in the spine also one will meet with histogenetic phenomena, circulatory relations, and trophism and irritability of the tissues, corresponding to the particular constitution ; and the same must be admitted in the case of a second and of a third combination, and in that of the mixed combination.

Wherefore the conception of the morbidity of the vertebral column is deduced from two facts—the total or partial excess of its development, and the type of the individual morphological combination.

When I shall deal with certain diseases relative to different morbid constitutions, we shall find in the clinical facts those coincidences, those morbid relations, certain morbid associations which will be disclosed by these morphological data.

The curvatures of the spinal column are acquired. At the time of birth traces of the true curvatures or vertebral inflexions, which later on make their appearance in the cervical and lumbar regions, do not exist. The former usually presents itself at the third, fourth, or fifth month after birth ; the latter much later in the course of the first five years. These curvatures are the result of mechanical adaptation, and not the expression of a primordial conformation. For this reason they have a physiological signification, and may acquire a pathological one according to whether they in their form and extension are regarded as the normal effect of the mechanical muscular function having the scope of maintaining the equilibrium of the body, or as the effect of muscular force for determining a special equilibrium ; in the latter case the curvatures of the column are found abnormal in one way or another.

The mobility of all the skeletal parts of the human body renders it necessary that the work of a given muscular group should determine the contraction, or, to speak better, a functional attitude adjusted to the case, of the whole musculature of the organism. If we wish, for example, to raise a body held in the hand by means of a movement of the forearm, the muscles which are inserted by one end on the arm and by the other on the forearm must contract ; but for the forearm to move it is necessary that the arm be kept fixed, and this requires the intervention of the muscles which connect the arm with the trunk. On the other hand, the reaction which the body raised exercises upon us tends to make the trunk incline towards the thigh, and to move the thigh on the leg, and then we must contract the muscles which unite the lower limb to the trunk, besides those which unite the segments of the lower limb with one another, employing the less energy the heavier the body raised. In short, it is necessary to prevent instability and the oscillation of the different skeletal parts, which, by means of the successive and co-ordinate muscular actions, are fixed on one another firmly, and render the skeleton rigid. It is evident that in the regular performance of all the above-mentioned mechanical functions we have an indirect proof of the harmony in the proportion of the parts and in their function.

We shall now consider, in order to make things clearer, the case of the unequal length of the inferior extremities. Here the maximum of fixation or stability of the different parts of the skeleton cannot be realized without, in the long run, some deviation of the spinal axis—a scoliosis, be it even of slight degree—having manifested itself. In fact, if the left leg, for example, is shorter, the corresponding hip abandons the horizontal plane, becomes lowered, and the body is inclined to the left; consequently the centre of gravity is displaced in proportion towards the lower hip, and the weight of the body dividing into two parts, the greater is felt on the left, and therefore the pressure of the right leg on the ground will be less. If the individual, having the muscles of both sides of the body equally developed, inclines the trunk to the right to restore the centre of gravity to its normal position, the vertebral column must become curved in a measure proportionate to the muscular action summoned to maintain the equilibrium in that given direction.

Well, a similar scoliosis may be the consequence also of very slight inequalities of the limbs; a slight scoliosis may likewise occur when the legs are equal, and the development of the corresponding muscular groups or their function, owing to some local infirmity, is, on the contrary, unequal.

Scoliosis may, besides, take place in children by reason of a faulty deportment, and also following muscular contractures.

If the curvature of the dorsal portion of the spine becomes exaggerated, there results a certain degree of kyphosis, which is due to a vicious deportment of the body, in which the trunk is held not in its perfectly erect pose, but inclined forward ; this comes from insufficient activity of the muscles proper of the column and those which fix the scapulæ to the thorax. The alteration of form and of function of the parts just mentioned has great importance, as we shall see, in the pathology of the respiratory organ.

The curvature of the vertebral column may be also the mechanical effect of the vicious deportment, necessitated by irregular muscular function depending upon either original unequal development or upon pathological causes.

As is seen from the careful and scrupulous observation of the form of the spinal column, we can reveal data which, however minute and unimportant they may seem to be, have nevertheless some physiological importance, and are useful for the clinic. I remember having, by means of these data, corrected diagnostic conceptions, and having conformably adopted therapeutic measures with full satisfaction. I remember a case of alteration of the knee-joint that was finally traced to its physiological cause, which consisted in an unequal development of the musculature of the thigh and of the nates, through which the regular exercise of the lower limbs proved fatiguing, necessitating a particular posture of the vertebral column, and was the consequence of the pains, which were erroneously believed to be of a rheumatic nature. And when one thinks that what appears at first to all a muscular fatigue, on thoroughly weighing matters resolves itself into an exaggerated function of certain parts of the central or peripheral nervous system, one has every reason for insisting in the idea that *everything which we have obtained from morphological observation is not by any means useless, inasmuch as it contributes to the aims of physiology and of the clinic.*

The programme for the systematic objective examination, such as is commonly made, does not refer in the least to the vertebral column, excepting when this presents one or another of those deformities which are individually registered by pathological anatomy. It is generally admitted that when the spine does not present any of these deformities it is in a normal condition. But since from the morphology of the human body we have been taught the variation of the individual organization, it is reasonable that in every individual we should note the development of the vertebral column, as well as of the other parts, in relationship with all the rest of the body.

In Dechambre's *Encyclopœdic Dictionary of Science* one reads : "It" (the length of the vertebral column) "is, as a rule, about 0·75 metre. The differences of stature depend mainly on the length of the lower extremities ; thus every individual who has short legs seems to have a very long body, and *vice versa*" (t. lxxx., p. 419).

These statements do not quite correspond to the reality, which consists in this : that, *cœteris paribus*, the vertebral column *may present many differences of individual development.* I cannot give here all the measurements which I have taken during several years of observation, but it will be sufficient for me to present a very eloquent fact for what I have stated. In reality, with a personal height of 144 centimetres one finds a spine of 56 centimetres in length, and with a height of 143 centimetres a spine of 68·5 centimetres ; with a height of 166 centimetres a vertebral length of 77 centimetres, and with a height of 170·5 centimetres a vertebral length of 72 centimetres.

This is sufficient to prove that with the complete study of the individual must be associated the verification of the mode of development of the spinal column. Positive results as regards the length of the vertebral column in the individual under examination can be obtained, not by its average length indicated by the anatomists, but by its actual measurement. Even admitting the laws concerning the growth of the human body fixed by Quetelet, we are certain that in the effectuation of these laws are always verified special cases—that is, variations. The anatomists and anthropologists have taken many measurements for establishing the differences which exist between the spinal column of man and that of woman, but it has subsequently been found that the number of exceptions is very considerable. It is said that in man the dorsal portion of the spine is longer, and that this corresponds to the greater development of the pelvis. In this connection Reich maintains that there are women with a very small pelvis and a relatively large thorax, who nevertheless present the most exquisite feminine mental characters, and that there are women who have a much-developed pelvis and a relatively small thorax, but who exhibit mental characters of a decidedly virile type. And similar exceptions are met with in the male sex, by reason of which it is clearly seen that certain affirmations concerning anatomical facts given in the tone of laws do not correspond to the reality. This acquires greater importance owing to the anatomical fact including a physiological one.

According to the researches of Ravenel, the vertebral column of woman is absolutely shorter than that of man, and in spite of this the medulla spinalis in both sexes is of the same length. On the other hand, the growth of the trunk takes place less rapidly in the female sex than in the male, and this is in relationship with the great nervousness of females with scrofulous and rachitic constitutions. Without entering now into the discussion as to the importance of these ideas, it will be sufficient to state that we are dealing with the results of researches conducted without method with the sole object of finding the averages, and not of forming series, according to the requirements of the morphological method, and that, notwithstanding this, from the results we see arise the importance which a new study of the vertebral column must have for recognizing the variations of its development in relationship with the whole of the body, including the medulla spinalis.

I have sought for observations and facts which have great physio-pathological value, through which I have been led to wonder that the necessity of instituting a special study of the spinal column, like that now being done on the forms and development of the skull, the form and size of the thorax, of the abdomen, and so on, has not been felt before.

For a long time I confined myself to noting certain coincidences which impressed me more and more till I felt the necessity of undertaking special investigations, during which I invented a method for the examination of the vertebral column. From this it is seen that I have had no preconceptions; the facts presented themselves to me gradually and spontaneously.

The coincidences which first impressed me were those of the longer spine, with the more or less marked symptomatology of neurasthenia; next that of the greater length of one or another portion of the column, with special phenomena of innervation of the relative spinal segment; finally, that of some therapeutic events instituted experimentally for seeing the confirmation or not of some ideas which gradually developed in me. Thus, from the consideration of the anatomical, physiological, and pathological circumstances, I succeeded in reaching the project of the method for the examination of the spinal column with the double scope—first, to discover the errors of evolution and development of this part of the skeleton ; secondly, to derive from them, if possible, some useful facts regarding the morphological conditions of the medulla spinalis.

To this new but interesting argument I wished to add the unprejudiced and critical observation of my coadjutor, Dr. G. Viola, who collected well-ascertained facts on the conditions of the vertebral column and of the medulla spinalis which fully confirmed the convictions that I had formed owing to my clinical observations, as I shall have occasion to show more fully in its place. Here it will be sufficient for me to state once more that clinical observation can disclose the way to new observations in the fields of morphology and biology ; this it could not do if it were not biological science. In spite of this, there are those who, not having yet understood the scientific spirit of this attribute, or seeing only its professional side, wish to deny it—an error which gives rise to no slight consequences and equivocations also in the didactic field.

Hence it will be demanded of me, What importance has the examination of the spinal column ?

From the above remarks the answer can be obtained. But I will add that if we admit that the morphological examination of the human body corresponds to the principles of the science, by reason of which no part of it must be omitted from our consideration to obtain a full and exact conception of the whole organism, it is readily understood that the vertebral column also in its variations of development must contribute to the constitution of the physiological and pathological individuality. We know, in fact, that up to the fourth month of intra-uterine life the medulla and the vertebral canal grow *pari passu* in length ; but after that period the spine grows more rapidly than the medulla, so that at birth the coccygeal end of the medulla corresponds to the third lumbar vertebra, while in the adult it reaches the superior border of the first lumbar. With these changes of the medulla and of the tube which contains it the nerve roots, which pass out of the vertebral foramina horizontally, assume an oblique direction. If the whole or a part of the vertebral skeleton grows beyond measure in a time shorter than normal, we shall have a morphological anomaly of the column, which offers us indications of eventual etiological relations as regards possible anomalies of the nervous system. Physiological attitudes and pathological manifestations, which indicate the influence of the nervous system, are met with both in animal and vegetative life. Theoretically, we can admit relations between the phenomena of life and the nerve ; but with the morphological examination of the column, and especially considered in its parts, we can carry the physio-pathological research on to a more positive ground. Further, if we reflect on what morphology teaches regarding the spinal metameres and their application to physiology and pathology, we shall see more clearly the great importance which the vertebral portion, more or less anomalous, has in respect to the section of the medulla that it contains. Finally, all must feel the necessity of being able to form at least an approximate idea with regard to the circulatory conditions of the medulla spinalis when they have to decide upon the various morbid processes and their most appropriate treatment. And also concerning this it is possible to acquire some useful ideas by means of the examination which I have proposed.

Later on we shall have occasion to discuss the pathogenesis of the different morbid processes of the medulla spinalis, and whether it is important or not to establish their mode of origin both for the treatment and prognosis ; here I shall confine myself to mentioning a case whose very important clinical history I shall give in its place, in which, against the diagnosis of disease of the internal genital organ, owing to which they wished to proceed to extirpation of the uterus, I maintained the diagnosis of spinal neurasthenia with venous congestion of the lumbar portion of the medulla. The grave symptomatology continuing after the operation, I was entrusted with the treatment, which gave the best result that could be desired. I remember a case of tumour of the mediastinum, verified post-mortem, in which exceptional symptoms in the circulatory system of the thorax presented themselves, whose interpretation could only be given as an anomaly of spinal innervation, due to a circulatory anomaly of the spinal section of the medulla, also verified by macroscopic and microscopic examinations.

I am convinced that this is an argument of the greatest interest, and I hope that others will follow in my footsteps, and will correct and improve the little which I have been able to observe, and have recorded.

From my observations I can admit that (1) *the length of the vertebral column is not always proportionate to the skeletal height ;* (2) *the length of the medulla spinalis is not in exact proportion with the length of the column ;* (3) *the greatest disproportions between the spine and the personal height coincide with the greater or less unequalness of development of the medulla spinalis ;* (4) *these modes of development coincide with manifestations of general or partial neurosis, with special functional attitudes of the nervous system, with special dispositions to ordinary nervous maladies ;* (5) *for the better verification of what precedes in every concrete case, every criterion derived from the knowledge of the morphology of the circulatory system (including heart, arteries, veins, and lymphatics) and from that of the general state of the patient must be made to contribute.*

Notes on the Morphology of the Extremities.

According to the most reliable anthropometric data, we have seen that the spinal column, considered in relationship with the height of the organism, diminishes after birth, and then increases till the fifteenth year.

With regard to the limbs, they, and especially the lower ones, increase up to adult age. This increased length of the legs is the chief cause of the difference in stature of different persons. However, the growth of each segment of a limb is not uniform, and in this way other differential criteria between individuals are established.

The growth of the limbs would be typical if during development the increase of the hand were less evident, that of the leg and forearm more, and that of the arm and thigh still more evident. But the growth of the parts does not always occur with such regularity. The disproportions most frequently met with are those which resemble others that are special to the anthropoids—the arms relatively longer, and the legs relatively shorter.

Other variations concern the extraordinary development in length of the femur ; others the development of the hands and feet ; others the greater development of the feet in comparison with that of the hands, and *vice versa ;* others, finally, concern the slight shape quasi-artistic of the hand with the clumsy and almost monstrous form of the foot.

I have made many observations on these skeletal asymmetries, and I am certain that they have importance, inasmuch as, after having verified the type of the individual morphological combination, I obtained criteria from them which enabled me to comprehend better the individuality, even when the other morphological data had a very clear signification. When I think of these facts, and remember the findings similar or equal to mine published by Schwalbe, I am sorry that in the data given by him are not included the relative biological conditions on which their value, and consequently their importance, depend.

When from the notion of the special individual morphology one rises to the physio-pathological conception of the constitution in every skeletal anomaly, one sees not only accessory criteria which confirm our idea of the constitution, but also the possibility of a morbid disposition in the part where the anomaly exists.

This is, in fact, one of the great advantages obtained by the application of morphology to pathology, by reason of which, *besides the revelation of the conception of the morbid constitution of the organism by the careful examination of every part, one also discovers the morbidity of each.*

By this means we succeed in understanding either the nexus of morbid phenomena, which otherwise could not have been understood save by etiological indications not always ascertained or ascertainable, or that certain morbid manifestations can coexist, though they do not always seem in relationship with one another.

It being now upwards of a quarter of a century since I began my observations on this method, I can maintain that it is surprising to see how in some cases the individual skeletal conformation goes on modifying itself from age to age. We see some individuals as they approach puberty, and after this gradually lose certain movements, not only awkward, but even suspicious, in the physiological line, and thus become almost perfect in their corporeal proportions; while others, who as children were beautiful, full of vigour, resistance, and bodily movements of every kind, with puberty and after begin to have an awkward deportment, to lose those proportions of the vertebral column, of the thorax and muscles, which were so symmetrical and consequently so promising. And together with these skeletal changes gradually occur physiological changes, which may unfortunately be followed at first by insensible, and then by profound nutritive constitutional, alterations, and by diseases which present all the characters of the constitutional morbid forms. And the nervous system very early offered indications of the sad future. Those will remember it who desire to know the true and useful facts without preoccupying themselves with theories. To me, owing to so many observations, some ideas have occurred which I think are not contrary to what biology teaches to-day concerning the influence which the different parts of the body and the nerve centres exercise on one another.

II. Inspection.

The part of inspection with which I shall now deal is made on the circulatory system.

By means of it facts are revealed which at first sight would seem of little value, while, as we shall see, they have a signification which associates itself with that of the anthropometric data, and sometimes substitute it in indicating certain congenital morphological relations.

I would mention that I take the term *circulatory system* in its widest meaning, which includes arteries, veins, lymphatics, and connective tissue.

1. *Lymphatic Glands.*

First of all I shall deal with the lymphatic glands of the neck, axillæ, and groins.

Of the lymphatic glands of the neck, those must be taken into special consideration which are found in the supraclavicular fossa, because together with the axillary glands they are in relationship with the thoracic lymphatic circulation (Krause). I have observed as an interesting fact that they present differences of development even in persons who are considered perfectly healthy.

Whether the patient has the lymphatic appearance or not, whether he has suffered from scrofulous affections or not, is of little moment in our case, which is that of revealing a morphological fact.

It may be said that the finding in question may be an accidental and temporary condition. That is true, but the careful anamnesis will decide it. In any case, the idea of the fact that these glands are unequally enlarged and sensitive to the touch, and have become so by virtue of one or another organic or functional circumstance, is not without importance.

I have made many observations on healthy individuals, and very many on patients suffering from different diseases which are not, as a rule, ascribed to the lymphatic constitution, and I have found that the above-mentioned glands—

Are either habitually developed more than the normal ;

Or very readily develop during every morbid condition.

This may take place in the neck, axillæ, or groins without the patients being aware of it.

If in two individuals, *cæteris paribus*, we meet with the above-mentioned lymphatic glands differently developed, or if in one we see them very readily become palpable and painful, we cannot neglect the fact.

There are reasons for the increase in size of that part of the lymphatic system, or motives through which the course of the lymph is not free, or, finally, bio-chemical anomalies and stimulations to the production of the glandular and connective-tissue elements of the parts with which the lymphatic district in question finds itself in relation.

Morphologically speaking, the regions in which the glands are constantly more developed than normal show that in them the lymphatic element in the structure of the parts predominates, or, in other words, as Hunter[1] has said, that in them there is a local disposition to lymphatic or scrofulous manifestations.

Physiologically speaking, when the lymphatic glands of the above-mentioned regions participate readily, and more or less intensely, in different clinical contingencies, one recognizes a special state of irritability of the lymphatic system, which, if I am not mistaken, the more important it is in pathology the less it is sought for ; while, in reality, it is sufficient to announce the fact clearly to recognize in it, not only a diagnostic indication of the individual morphological type, but also a therapeutic indication according to the cases.

All these things, generally special to lymphatic constitutions, refer particularly to infantile pathology, to that of the child and of the youth. Similar conditions are much more rarely met with in the adult, but I have never observed them in the old, excepting as the relics of partial morbid processes. However, I do not deny that they are possible in them.

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[1] Hunter, *Œuvres complètes.* Paris, 1843.

From my experience, I can state that there are children and youths who in the turgidity of the glands show a symptom of actual anomalies of the digestive process, and then this symptom becomes modified with the anomaly of digestion, or a symptom of alteration in the process of general nutrition. In other individuals these glands are endowed with extreme irritability for all external causes.

Whether it be in diseases of the chest, or of the abdomen, or in diseases with a general process, these glands always help to specify more clearly the quality of the patient.

In some cases observation proves that the most detailed knowledge regarding the development and morbidity of the lymphatic system contributes also to the better understanding of some general states which occur in youth. There are certain acute febrile processes, characterized by continuous or remittent, and occasionally also intermittent, fever, and by gastro-enteric symptoms with some participation of the sensorium, which are classified among the anomalous infective processes. They recur frequently in youth, and occasionally bronchial symptoms also manifest themselves. In this case the suspicion of acute tuberculosis arises. Well, having been able to follow carefully the course of affairs during and after the disease, I have convinced myself that similar processes develop especially on the substratum of the general internal lymphatic apparatus, with greater accentuation in one or in another part of the organism.

I think that, admitting the scientific idea obtained from morphology, from the individual lymphatic type, or otherwise from *lymphatism*, many morbid processes must be referred to this special organic constitution. The most recent biological studies as regards the organizaton of the *being* and its growth recognize the great influence of the lymphatic system ; morphology teaches the anomalies of development of this system ; everything induces us to recognize its importance in pathology. Therefore I marvel when a certain pathological anatomist, who is included among the ablest, takes pleasure in reviling clinical conceptions derived from the above-mentioned scientific sources, and confirmed and illustrated by sound clinical observation.

My observation began with noticing the coincidence of the appearance of the lymphatic glands in question with the beginning of a disease, and of their disappearance after its cure. To this coincidence was associated a fact of much importance—namely, that as soon as the disease had exhausted itself special changes in the constitution of the patient took place, which were faithfully represented by the state of the glands ; that is to say, either the growth of the individual, or an improvement, or the reverse, of his general state occurred. The patient, who before his illness was changeable, dyspeptic, and subject to frequent attacks of catarrh of the mucosæ, later became strong, well nourished, and acquired unhoped-for health ;[1] or if before he had had the appearance of health, and perhaps even of floridness, after his illness he did not regain his former state, and wavered constantly between disturbances of the chest or of the abdomen till, finally, a chronic state for years incurable declared itself.

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[1] In the *Riforma medica* (1885) I have given examples of the resolution of scrofulous conditions of the lungs following febrile disease. The following case, which is of special importance, occurs to me. It refers to a girl of sixteen years, with turgidity of the cervical glands and fever, which, owing to the absence of an inflammatory focus, at first sight seemed to be due to an infective process. By reason of the state of the glands of the neck I was induced to examine carefully the mediastinal organs, and I noted increased resistance to percussion on the manubrium of the sternum ; a little later in the apex of the left lung—the side where the turgidity of the glands was greater—I observed dulness and subcrepitant râles, and finally the symptomatology of a lobar pneumonia. Resolution appeared to have set in on the eighth day. The glands of the neck had almost disappeared, the fever had ceased, and the pulmonary function was restored. But when the time came for the patient to leave her bed, the fever reappeared, and with it were initiated symptoms of gastro-enteric catarrh with diarrhœa. At the apex of the left lung the crepitant râles, with the other symptoms, again made their appearance, which, together with the progressive wasting of the patient and the intermittent quotidian fever, rebellious for two months to every kind of treatment, led to the diagnosis of scrofulous broncho-alveolitis. Although the fever continued after such a long time, and the patient presented the appearance of pulmonary phthisis (the right lung presenting a similar alteration), we saw a gradual diminution in the thoracic symptoms, the total disappearance of the glandular turgescence, suspension of the fever, return of the appetite, and complete resolution of the whole of the morbid condition. The patient had served for a clinical lecture, when the phenomena of pneumonia of the left apex developed themselves, and was presented to show what subsequently occurred with regard to the data offered by the lymphatic system. Later, when the phthisis was evident to all, she served as a clinical case at the final examination for the degree. And finally, when she was about to be dismissed completely cured, she greatly surprised all those who had seen and examined her in the above conditions.

In fine, I must add that all these things are verified when the organism is passing through one of its principal evolutions, during which, as is known to all, notable change in the conditions of the organization may take place.

2. *Fat and Panniculus Adiposus.*

After the glands, I shall now direct my attention to the development of the subcutaneous cellular tissue—the panniculus adiposus.

The presence of this, within certain limits, renders the form of the body roundish and more pleasing, while it denotes a satisfactory condition of the general nutrition; but beyond these limits it represents a relative anomaly of the constitution, and generally a morbid lymphatic condition.

For this reason, in every case one should not only note, as is done for alluding to the better trophic conditions, that the panniculus adiposus is more or less abundant; but should also take it into consideration as a morphological characteristic which expresses a lymphatic constitutional state that may refer to the whole or to a part of the organism, according to whether we see the panniculus adiposus excessively developed in every part or in a particular locality.

I cannot agree with what others have asserted—that equal relations always subsist between certain attributes of general innervation and the amount of development of the fat in the subcutaneous cellular tissue, and especially in the abdominal cavity—inasmuch as I have found irritable and torpid persons with much nervous energy, and others depressed and depressible showing the same tendency to become fat. Here we must mention that much still remains to be known as to the different influence which the lymphatic system exercises on the other parts of the body.

Instead of establishing coincidences purely theoretical between the different temperaments and the quantity of fat collected in the body, I wish to adopt an idea of Liebermeister—that when a man becomes fat, it generally indicates a diminution of the vegetative functions.[1] We shall take the word "diminution" to mean *degradation* for morphological regression.

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[1] Liebermeister, *Handb. d. Patholg. und Therap. d. Fieb.*, p. 181. Leipzig, 1875.

Further, in order to form a just criterion concerning the quantity and the mode of development of the fatty tissue in the person under examination, besides verifying what is found in him it is necessary to distinguish whether he belongs to a family in which obesity predominates, or whether this is the consequence of excessive introduction or of a sedentary life. For the increase of the fat in the body of the lower animals and of man occurs not only through the deposition of fat in the connective-tissue cells, but also by means of the true production of fatty tissue. This, according to Toldt, represents, as we have already said, a particular tissue with a special system of vessels, whose product is fat, and represents morphologically an inferior production.[1]

By virtue of this, one can maintain that the individuals who are rich in fat belong to the lymphatic constitutions ; and equally that the individuals in whom fat is produced beyond the ordinary amounts in some parts of their body demonstrate in these parts a morphological anomaly with a lymphatic character.

Therefore, in no age of life can the excessive production of fat be held in esteem. When an individual presents abundant panniculus adiposus, he is, as a rule, said to be, but erroneously, of excellent nutrition and healthy. It is nearly always excessive ; and in spite of the healthy appearance of the body, sooner or later morbid conditions will manifest themselves, according to the age, constitution, habits, and other circumstances relative to the individual, or to the surroundings in which he lives.

All remember the infants, children, youths, and adults who from the state of health, apparently enviable, passed to that of a desolatory chronicity, or miserably ended in a constitutional or other disease, in which fatal phenomena inherent to the nature of the patient presented themselves as a complication.

I believe that hygiene can do much in this connection, both in finding the method which will transform the organisms and in educating the masses to judge things better and to seek scientific advice in good time.

I have observed that in all ages the richness in fat coincides with a particular form of the body, in which certain morphological relations that I shall indicate later on are always verified.

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[1] Toldt, *Sitz. Br. d. k. k. Acad. zu Wien*, B. lxiii., Abth. 2, pp. 445 and following, 1870. To this opinion of Toldt correspond the observations of Flemming.

As is known, there are many individuals who are not fat during the whole of their life, but are thin at one period and become fat at another, and *vice versa.*

This indicates that the production of fat is connected with definite morphological conditions, which during the evolutionary phases of the organism either always remain equal or become modified.

Moreover, the kind of alimentation, an inert life, oligæmia and a special influence of the nervous system, favour excessive obesity.[1] Nevertheless, these factors must be considered only as secondary ones, for though they increase the amount of fat, they do not produce by themselves alone that condition which we study in the morphological relation.

There are infants who seem monstrosities, rather than examples, of good nutrition, so disproportionate is their production of fat; but when they have reached primary dentition they become transformed, and at the secondary are quite different from what they were. As children, they show a disposition to catarrhal affections of the abdomen or of the thorax, and lose flesh. Some, as adolescents, grow fat, and when they reach adult age have much fat in the abdomen or much panniculus adiposus in the whole of the body. While these corporal changes are taking place, therefore, the fundamental character of the morbidity becomes modified.

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[1] The young wife of a fishmonger after marriage had lost her health, and fell a prey to hysterical symptoms, including general convulsions of a characteristic kind. At a certain period the convulsions disappeared, but she was seized by an insatiable appetite—the stomach was voracious. She had to eat continuously to suppress a sense of fatal anguish, by reason of which she had acquired an expression of extreme suffering, and in the long-run her mind gave way to manifestations of a depressive character, like a psychopathic. Meanwhile, from being thin she began to grow fat, and in a short time increased beyond measure. In this state she presented herself at my clinic. I shall not occupy myself with her history then obtained, and shall speak only of what interests us here. I obtained no advantage from the treatment, though I treated her with the presumption that the nervous system played a great part in her sufferings. Therefore the patient returned home believing that she was about to end her days. Instead, it appears that, owing to the unkind treatment of her husband, she was taken anew with an attack of hysterical convulsions, and then the scene began to change. The appetite, digestion, and general nutrition were corrected, and the patient recovered her original state of health.

In another patient suffering from hystero-epilepsy we verified the following: When she was thin, she had only rare attacks of epilepsy larvata; when she began to put on fat, she was taken with severe attacks frequently. In this case the stoutness was very relative, and did not amount in the least to polysarcia.

Now I must state that the morphological relations in these two patients were different: in the former is represented the type of those who are predisposed to obesity; in the latter we have a morphological type which approaches the ideal.

From this one sees when the nervous system influences the state of general nutrition, but the influence is specialized by the organic dispositions generated by the individual morphology.

There are others who in this respect, from infancy to youth, and even beyond it, remain thin and emaciated ; then, when they reach adult age, they begin to put on fat. There are others, finally, who do not grow fat till after forty years of age, and may reach an extreme degree of obesity.

Whatever be the cause which is anamnestically accused, I believe that all these changes are connected with the mode of evolution of the organism ; and when it is necessary to know fully the natural history of a patient, it will be also useful to take note of the modifications which have occurred in his general nutrition, and especially whether he has been successively either thin or fat.

The phenomena of the evolution of the body cannot be completely valued if we do not succeed in co-ordinating them with those from which they were derived. Clinical pathology founds on this knowledge its special capacity, because in many cases the simple verification of the actual facts either keeps us within the limited sphere of ordinary empiricism, or lets us fall into the snare of some hypothesis, destined, like many other hypotheses, to disappear.

That which I propose to contribute is not a pure hypothesis, but the verification of a fact and of its relations with other facts which have preceded or are associated with it, in order more thoroughly to know its physiological value in an inferior organism. It is an attempt to lead our science into that *determinism* which renounces hypotheses as the natural doctrine concerning facts extends.

In reality, following this direction, we shall be better able to discern the different reasons, the various modes by which individuals become fat, and to deduce with greater certainty the therapeutic indications.

According to these principles, I find in some cases that the sole fact by virtue of which a thin person becomes fat during or soon after a definite disease—which is, as a rule, of the stomach, heart, or nerves—constitutes the necessity of the treatment which is advised only in polysarcia ; while I recognize that the treatment must be differently carried out according to the different pathogenesis.

But I have said enough for the moment on this question, wishing to confine myself here to a few notes which explain my method of inspection that I have followed for years.

3. *Subcutaneous Veins.*

Attention is generally attracted to these veins when, owing to their excessive development or to definite symptoms, one has reason to believe that circulatory disturbances, either central or peripheral, general or local, exist.

I do not speak of these, but of the subcutaneous veins which are to be seen independently of every hydraulic alteration.

We shall consider those of the chest, abdomen, and extremities.

In order to be able to value the facts inherent in the particular development of the veins, it will be necessary to begin by comparing two or more individuals, if possible, of the same form. When this is done, one sees that the veins of the above-mentioned regions present a different degree of development either in number or in size.

Repeating these comparisons, we end by acquiring the conception of the proportionate and disproportionate development of these vessels, and we shall find also individuals in whom they would seem to be—though very rarely—much less developed than in the majority. There are also individuals in whom, without following my ideas, one can positively say that the veins are greatly developed.

By the greater development of the veins I mean their large calibre and turgescence, besides the greater number of branches which unite with the veins that are indicated with special names by the anatomists.

The facts which I have verified as to the excessive development of the veins may be briefly summarized as follows :

Some individuals have a rich or very rich subcutaneous venous network in the whole body, or more especially or solely in some part of it ;

Others present only turgidity of the veins in greater degree ;

These different conditions may be found regularly or irregularly distributed in the body.

What do these facts signify ?

They have both a theoretical and a practical value. Theoretically, they refer to the variety of organization, not only of the individuals, but also of the parts of an individual, compared with one another. Hence arises a special physiological condition, and eventually a definite local morbid attitude.

Practically, they demand—when we have to deal with individuals in the age which precedes the final evolution of the organism—careful hygienic and therapeutic treatment, with the scope of protecting the patient from positive morbid manifestations.

Many of these things are already known to physicians, because daily experience has shown them to be manifest coincidences which, on account of their constancy, have acquired an empirical value. But here we have to deal with substituting the empirical idea by the scientific conception of morphology and applying it more justly.

An example will make this clear. On the chest of children and of adults we occasionally see more or less clearly veins which traverse the median line in different directions ; sometimes we also see one or two venules in the second intercostal space, which, after a short course, become deep, and in certain circumstances dilate under the influence of the respiration. Other venules may be seen passing from the median line towards the subclavicular regions. In my opinion these veins denote a special condition of the intrathoracic venous circulation, by virtue of which, even if the patient under examination has no symptoms of disease of the chest, I infer that one must investigate more diligently the predisposition to it.

What this special circulatory condition consists in must be interpreted according to the foregoing general principles. It is certain that the veins, abnormally apparent, express a state of augmented internal pressure, which one must necessarily admit exists in the azygos veins into which the intestinal veins flow, and in the superior vena cava, the right cavity of the heart, and therefore in the environment of the pulmonary artery. This, consequently, in the interstitial circulation of the tissues composing the respiratory organs, keeps up those factors which favour the torpor of the lymphatic circulation ; hence the ready turgescence of the lymphoid tissues and of the lymphatic organs, and eventually their ready production with the relative clinical manifestations.

In these cases hygiene must in good time make use of its means for modifying this state of things ; and the clinic, in the presence of the more simple as well as the most grave symptomatic appearances, must recognize the relationship which exists between these and the morphological condition of the venous tree, besides their constitutional character, and employ the best subsidies which certainly are not simple drugs, but the most potent modifiers of the organic functions.

It is on the belly especially of children and youths that we see the veins winding from the hypochondrium upwards. On rare occasions they are almost regularly disposed ; when they are not, they take a direction between the right hypochondrium and the median line. From my experience, I can state that these veins denote a state of greater development of the hypochondriac organs. In several cases I have been able to observe the successive expansion of a true venous network in the above-mentioned region in connection with disease of the liver and of the spleen in individuals who, before they had presented the symptoms of the disease, had these veins unusually visible.

When this condition of the veins exists, we observe, as a rule, another important fact in the form of the belly, which I shall speak of later on.

The clinical history—very important from several points of view—of hæmorrhoids is associated with facts analogous to those just mentioned. Neglecting all the other causes which we know help in the production of piles, we can say that these make their appearance when the venous circulation is impeded by central conditions, or owing to difficulties arising in the portal circulation ; and that in some individuals, independently of these circumstances, the hæmorrhoids declare themselves as the effect of a special individual disposition. This consists in an excessive development of the local venous network, as I have mentioned in another part of the book.

It is met with precisely in those in whom we see in different parts of the body, but especially on the abdomen and the lower extremities, the veins abnormally developed both in number and size.

We shall see in another place further morphological criteria which enable us to recognize this preponderance of development in the venous network of the belly (I always mean relative preponderance), and how, from the ensemble of these indications and other anamnestic and objective notions, it is possible to recognize the morbid disposition to different infirmities.

Continuing our remarks regarding the development of the venous system, we shall see other important facts. Some thin individuals and others fat, for example, are notable for the richness of the veins in the whole body or in some parts of it; while there are thin persons and fat persons who in this connection do not present any notable fact. Well, if we compare the morbidities, diseases, and symptoms of these different individuals, we shall readily comprehend that part taken by the irregularity of development in the venous system.

All this appears clear, especially in cardiacs, in whom the same lesions present themselves differently in the secondary symptomatology, according to whether or not they have the primary morphological condition in the circulatory system. It is sufficient for the present to mention that in some cardiacs, *cæteris paribus*, we find the phenomena of defective circulation earlier and predominating in the province of the pulmonary artery; in others in the general peripheral circulation; in others, finally, in the abdomen—and in those of the abdomen there are cases in which differences are met with prevailingly in the phenomena of the defective portal function, or in those of the defective function of the inferior vena cava. Further on, in the *Examination of the Abdomen*, greater details will be given which indicate how, from the information acquired on the development of the veins in the legs, a morphological criterion can be obtained which assists us in judging the development of the vena cava inferior.

If in a healthy individual it is not an easy task to obtain from the examination of the external venous system indications as to the condition of the internal, when the symptoms of disease begin and increase the indications sought for will be rarely wanting; and if causes capable of masking them supervene, such as œdema, there are other researches, other data, which will enable us to make a sound diagnosis.

4. *Arteries and Capillaries.*

(*a*) I shall now proceed to examine the arteries.

Here also, if we institute comparisons between different individuals, *cæteris paribus,* concerning the development of the arteries accessible to examination, we shall quickly perceive that they likewise are not equally developed in all persons.

If, besides, in making these comparisons, we take into consideration the physiological and pathological history of the individuals, we shall immediately see coincidences which cannot be accidental, as I shall show further on.

In the course of many years of observation, I have collected numerous facts and anatomical coincidences, which I summarize in the following propositions :

There are individuals who present small arteries generally, or confined to certain parts. In several cases, for example, the radial of one side is smaller than that of the other.

The smallness of the arteries coincides with some morphological attributes, or otherwise with certain constitutional peculiarities. In some cases I observed an absolute defect in the development of the arteries coincide with an absolute excess in the development of the veins.

As a rule, cæteris paribus, we can admit that the arteries are small in those individuals in whom the manubrium of the sternum has a development in length equal to that of the body.

Even before now I have referred to the relationship which exists between the development of the manubrium of the sternum and the development of the heart. Here I must recall the fact for the application which can be made of it as regards the opinion that one has to form on the development of the arteries.

By means of this fundamental criterion, one arrives at the scope with surprising facility. In fact, if, when confronted by two persons, we desire to know the degree of development of the arteries, having made the above comparison relative to the sternum, we can maintain that in the two persons the degree of development is greater or less, according to whether the gladiolus of the sternum or the manubrium is the longer in proportion.

If we add to this the criterion concerning the development of the left ventricle, as we shall see immediately and in other places in this work, we shall be able to form our judgment on the development of the arterial system in general. After this nothing remains to be done but to compare the corresponding arteries in the different parts of the body with one another.

(*b*) We now come to the capillary circulation, which also deserves observation.

In a general way one can maintain that the colour of the skin is in relationship with the quantity of the capillaries found in it —that is to say, the pallid or rosy or dark-red colour prevails according to the scarce or more or less abundant expansion of the capillary circulation.

But the crasial condition of individuals is not through this in relationship with the colour of the skin, inasmuch as we meet with pallid individuals having a good blood-crasis, and high-coloured ones who, on the contrary, are not well provided with red corpuscles.

And though these facts are known to all, I believe it is necessary that they should have greater consideration, because when they are connected with all the other phenomena which we shall note they will acquire greater importance.

Further, besides the examination of the mucosæ which is usually practised, I believe that it is useful to take note of the colour of the capillary circulation, especially of certain parts.

These are the face, hands, and feet.

In some persons the face presents, instead of a rosy colour, a more or less dark red one. The lips and the conjunctivæ, owing to the richness of the capillaries, may be as intensely coloured as in the healthy; but the colour of the face above-mentioned indicates the fallacy of the colour of the mucosæ, for that tint is due not to the active and plentiful circulation of the arterial capillaries, but to torpor of the capillary circulation. One sees it, in fact, coincide with signs of previous scrofulosis, or of incipient scrofulosis, or with other conditions, among which I mention some which refer to the development of the veins and arteries; by means of which, in the cases where the foregoing conditions have not yet been verified, or the anomalies—or, rather, the disproportionate development of the arteries and veins—are not distinctly recognizable, with the help of other morphological criteria, the speciality of the constitution, which is, as a rule, the lymphatic, will be demonstrated.

The same can be said regarding the capillary circulation of the hands. Some have hands of a bluish dark-red colour, generally cold and readily perspiring. These hands are ugly, short and thick, or long and broad, with large phalangeal joints ; or they may be plump and almost fat. Such characters appertain to individuals who are subject to chilblains and present different morbid conditions according to the causes which the individuals meet with, but which have a chronic character and are kept up by the circulatory torpor in the parts.

On the skin we can study another phenomenon relative to the capillary circulation, of which I have written in another work, and which I called *paralytic lines* or *streaks*.

Trousseau was, I believe, the first to observe that when, in those affected with meningitis, the finger-nail is drawn over the skin, it makes a red line, which is called Trousseau's spots, or *tache méningéale.*

Having observed from the early days of my study of semeiotics the same phenomenon also in individuals who had not meningitis, but were suffering from other morbid processes, and even in those in perfect health, I became convinced that the signification attributed to this vascular phenomenon is not the true one, and that this probably could be found.[1]

Thus began the observations which are now innumerable, and from which I have obtained what follows.

If the back of the index-finger or the edge of the finger-nail be drawn with slight pressure along the skin, after a short time a red line appears, which is broader in the former case.[2]

It is easy to value this phenomenon ; but to understand thoroughly its signification one has to know it in its multiple manifestations.

Above all, it is necessary to know that in the same individual one sees this vascular phenomenon present different degrees in different parts. In these its mode of presentation is not equal, as the following facts will show.

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[1] While occupying myself with the above detail, I read an article by Coneato entitled "Dermografia." He, having met with the above phenomenon very marked in an individual, was induced to make it the object of special study. I mention this because it shows that this phenomenon has fallen under the observation of others, it not having ever been, so far as I know, taken into consideration from the point of view which I consider fully justified by physio-pathology.

[2] In place of the index-finger we can use the end of a lead-pencil, etc., as the result is the same. However, he who wishes to act methodically should always employ the means with which he began his observation on the individual. The reason of this is so obvious that it is unnecessary to say another word about it.

As a rule, one can say that in the fine skin of weak, erethistic persons the vascular phenomenon is obtained more quickly and distinctly. From this one understands (speaking generally for the moment) what its value can be in other individuals when it manifests itself in them ; and one equally understands that the condition of innervation which regulates its appearance must vary when, in the same person, one observes variants relative to the place in which the phenomenon is studied and relative to time.

The paralytic lines exhibit some details which deserve mention ; that is, the red linear spot is surrounded by a very narrow whitish line, which readily appears in individuals of a white but not milky-white skin. This whitish line, which contrasts with the red one, is sometimes more manifest, for it is broader, ribbon-shaped. If, then, we observe the relations which exist between the central red colour and the peripheral white one, we shall see in some cases the following succession of facts : (1) The spot on which the finger has been drawn becomes immediately pallid ; (2) this pallidness is followed more or less quickly by redness, which gradually gets more vivid and wider, the length remaining unchanged ; (3) while the red line is developing, the white line makes its appearance around it, and as the former widens, the latter is displaced. All this, as is natural, occurs in proportions which vary according to the individual and to circumstances.

Occasionally I have seen a pale or white line instead of the red one on the skin where the finger was drawn ; and I have seen it, more or less wide, last for a short time, to be followed by the normal colour, or last for a long time (longer than the red ones), and then disappear in from a quarter of an hour to several hours. This condition was rarely observed ; but when it was, I have on several occasions been able to reproduce it in the presence of my students, and have showed them that the skin conserved the trace of the digital impression made in the shape of a circle, of a letter of the alphabet, etc. It occurred only in patients suffering from certain diseases, of which I shall speak later on.

Having qualified the red lines by the adjective *paralytic*, we must qualify the white ones by the adjective *spasmodic*.

These two terms prejudge, it is true, the question concerning the mode of production of the phenomenon; but they have been suggested by experience and by the science. Both agree in maintaining that when, owing to a given impression in a region of the skin, redness is obtained, it signifies a greater expansion of the vessels by reason of the cessation of the vascular tone; and the contrary, when the impression is succeeded by pallidness, signifies vascular contraction.

I uphold these criteria also because otherwise I would not know how to explain the redness in question—that is to say, the action of the nerves on the vaso-dilators—while in reality the exact valuation of the facts appears to me to strengthen this idea.

We shall now proceed to examine the succession of the following facts: The digital impression is sometimes followed by a white line which becomes red in the centre; then this spreads, as does at the same time the white line surrounding it. In this case, it being necessary to maintain that the primary appearance of the white line indicates vascular spasm, the contrary fact—paralysis—must succeed when the white or pallid colour is substituted by the red one.

Consequently, I believe that the terms *paralytic* and *spasmodic* lines correspond to the reality of the facts. Among the variants of the vascular phenomenon in question, one was recorded in which the paralytic manifestations persisted for hours, sometimes even for twenty-four hours and more, and also another in which was seen a swelling of the red part alone, which could be considered only a localized œdema.

It would be important to discover whether these paralytic and spasmodic phenomena in the capillary vessels take place directly or in a reflex way.

My observations were also directed to this scope. But I have not been able to acquire certainty regarding the reflex origin of the phenomenon, because I have not verified its exact and invariable correspondence with other reflex phenomena in healthy as well as in diseased persons, the latter suffering from different diseases, including those of the nervous system.

I cannot deny, however, that with the modification of the central innervation the phenomenon in question is not also modified eventually. Therefore I am inclined to admit that it is produced directly—that is, by the activity of the ganglia which are scattered along the vessel walls.

This is not opposed in the least to the idea that the modifications of the nerve centre in definite cases have influence on the activity of the vessel ganglia.

But what is the physio-pathological signification of the phenomenon? In my opinion, the following consideration explains this clearly. Seeing the influence that the nervous system exercises in every way on the vessels, one can infer from it that the nerve fibre, the stimulator of their activity, is subject to different degrees of excitability. Consequently, *from the examination of the phenomenon up to now considered, we can form an idea of the quantity and quality of the vasomotor function which predominates in the concrete case.*

One understands that this notion is not deprived of value, especially when one is desirous of acquiring as full and exact a conception as is possible of the individuality on which one has to make a diagnosis.

From the foregoing facts is derived another conception—namely, *that the hyperæmic or paralytic lines, and the spasmodic or ischæmic lines, express both a local and general condition of functional excitation.*

I shall now state briefly the result of the observations instituted in pathological conditions.

In some cases of acute and chronic diseases of the chest I have seen the hyperæmic lines manifest themselves quickly, and last so long as certain morbid phenomena persisted.

Since then I have adopted a rule which I always follow—namely, that the research of these lines has to be general and local.

In fact, in diseases of the chest the phenomenon sought for on the chest and abdomen appeared in the pathological form in that and in the normal form in this. When the thoracic symptoms had disappeared, the lines of both regions were similar.

These facts have been verified very frequently by me, and shown to my students, so that I can maintain positively *that, during the course of chest diseases, the vascular lines on the skin of the thorax may present modifications in relationship with the morbid state of the viscera.*

In the first edition of my book *Patologia del simpatico*, published in 1876, treating of reflex phenomena *ab interno*, I demonstrated their existence by means of clinical facts of undoubted value. Since then others have taken up this question, and have shown independently that which I had first demonstrated. Therefore, to explain the mode in which the hyperæmic lines present themselves, I here admit the mechanism of the reflex phenomena *ab interno*, on which I shall speak more diffusely elsewhere ; that is to say, I admit that the activity of the vasomotor fibres of the skin of the thorax are modified by the influence of the thoracic affection, which can manifest itself only through the spinal centre.

In cases of abdominal diseases I have also seen a large number of times that the vascular phenomenon presented itself differently on the skin of the belly than on that of the thorax and of other parts. Consequently I maintain that *also, during the course of abdominal diseases, the vascular lines on the skin of the belly may present modifications in relationship with the morbid state of the viscera.*

The explanation of this fact is naturally the same as that already given.

It would be important to know the semeiotic value of the paralytic and spasmodic lines in connection with alterations of the viscera. With regard to this connection I have little to say, but that little has been well verified. In two cases of abdominal disease with peritoneal alterations, instead of the paralytic lines (red), I obtained the spasmodic lines (white). In these cases, with the changing of the peritoneal conditions, the spasmodic lines were no longer obtained. I do not record many other observations, because they were not conclusive ; but from all I can deduce that, while the examination of the vascular phenomenon gives us an idea of the conditions of vasomotor innervation in the individual, and while it demonstrates that the pathological state of the viscera can modify it, we cannot admit that the mode of presentation of the phenomenon corresponds to definite visceral pathological circumstances, but only to pathological conditions.

The following singular case is worthy of record : In a man on whom were several times verified in the course of years phenomena of altered sensibility in the arms, with œdematous swelling, through which he was unable to work, the experiment of the paralytic lines gave the following extraordinary result : on the skin of the chest I wrote with a point (metallic, if I remember rightly) the name of the patient, and *this appeared in paralytic lines, which lasted for over twenty-four hours, and then slowly disappeared.*

On exposing the chest of patients—as a rule, women—we sometimes observe the appearance of reddish spots, resembling cutaneous hyperæmia, which under pressure disappear and are again renewed. These spots may be irregularly distributed, may enlarge, unite together, last during the examination, become modified in their contours, and be reproduced at each examination.

Although rare, another vascular phenomenon has also been noted, which consists in a true turgidity that must be œdematous, and which follows the appearance of the hyperæmic lines and disappears with them.

In two cases these cutaneous vascular phenomena were associated with another vascular phenomenon verifiable in the carotid arteries ; these pulsated, as is seen in exophthalmic goitre. I thought that a corresponding concitation of the heart also existed, but on examination I found it was not so. In these two cases one must maintain that the vasomotor innervation produced the vascular phenomenon of the skin and of the carotids separately.

To understand the importance of these facts one must connect them with the general condition of the patients in whom there were coexisting two pathological factors—lymphatism and neurasthenia. In both patients there were scrofulous manifestations in the cervical glands, symptoms of broncho-alveolitis, and nervous phenomena, commonly attributed to hysteria.

We shall now consider the arteries. That they are endowed with contractility is known, but this fact has not been applied clinically in the way that I am about to describe.

If while one is feeling the radial artery, for example, and has noted exactly the quality of the pulse, one exercises on the vessel a strong pressure (as is done in practising massage) for from three to eight seconds or more, according to the cases, and then feels the pulse again, one will verify some modifications in it, which vary according to circumstances.

With normal arteries the pulse contracts in the portion of the artery massaged. Sometimes it disappears, and then gradually reacquires its normal condition. At other times it expands beyond the normal after compression.

With pathological arteries the pulse contracts less, or does not contract at all.

The absence of contraction is a phenomenon which depends on two factors—namely, nutritive alteration of the artery (atheromasia), and *defect of nervous action.*

I have verified these conditions in the radial, brachial, carotid, temporal, abdominal aorta, femoral and dorsalis pedis arteries, also by means of suitable sphygmographic tracings.

Sometimes one observes an exact coincidence between the excessive contractility of the arteries and the spasmodic capillary lines, or defect of contractility of the arteries with the paralytic lines. Other times, instead, the converse takes place.

The vascular nervous phenomena are not always in relationship with the degree of nervous excitability, inasmuch as it may happen that the arteries of one province may react differently to those of another.

In some patients, making another feel the right radial pulse, for example, while I massaged the left radial, the simultaneous contraction of both arteries was verified.

Taking into consideration the different mode of behaviour in the same individual, both of the hyperæmic and spastic lines, and of the contraction of the arteries in the different parts of the body, one understands *that while the vasomotor innervation is subordinate to the nerve centre, it is, nevertheless, within certain limits independent, autonomous.*

The verification of this fact in the concrete cases, together with the study of the nervous system according to the scheme already traced, will give us some useful notions regarding the interpretation of local and general morbid facts which recur especially in many pathological cases.

5. *Inspection of the Thorax.*

I intend to speak here, not of what is usually mentioned in the books of semeiotics on the inspection of the thorax, but of what I have obtained by my method from my own observations. Further on I shall describe the measurement, where it will appear that to its data it is necessary to add others before arriving at a conclusion on the respiratory capacity as it is generally practised.

That which I am about to say concerns especially some anatomical particulars and the thoracic excursion.

With regard to the former, independently of the size of the thorax, I have seen and confirmed that we must suspect a weak constitution, therefore a special morbidity, whenever the first and second intercostal spaces are very wide in comparison with the others. This condition is connected with another—namely, a length of the manubrium of the sternum disproportionate to that of the gladiolus. And this is, as I have already mentioned, in relationship with an irregular evolution of the heart.

In a general way I can maintain that in these conditions one can have a heart relatively small, and the aortic system developed in proportion.

Then, as regards the thoracic excursions, I maintain that we must judge of the respiratory capacity during the normal excursions, such as are made by the individual when he is unconscious of our observation.

In reality, the physiological phenomena which such individuals present are two : one is the short thoracic excursion ; the other is the possibility in which one finds oneself of making large thoracic excursions. The former is the constant fact, to which must be attributed the importance of a sanguineous oxygenation relatively less than it should be, consequently of a pulmonary circulation also less rapid than it should be, and hence the cause of some morbid phenomena. The other phenomenon demonstrates to us, on the contrary, a certain capacity which exists to modify these physiological and pathological conditions ; therefore the indication for certain hygienic precepts which may also possess therapeutic value.

The thing is simple when one reflects that the thorax may be, as is known to all, small, narrow, cylindrical, etc., or may be large, wide, but not regularly constructed, owing to the fact of the first and second spaces being too wide (later on we shall see the importance of this) and provided with weak inspiratory muscles. This circumstance places the big thorax in conditions similar to those in which a narrow chest is found. The sole difference consists in the possibility which subsists in the former that the conditions of the intrapulmonary circulation and of the nutrition of the tissues of the lungs may be changed by the respiratory gymnastics indicated by hygiene and therapeutics.

Daily experience teaches us this, and fully confirms the above-mentioned facts.

When one advises indiscriminately respiratory gymnastics to certain individuals for protecting them from, or curing them of, chronic diseases of the respiratory apparatus, we see that some of them derive advantage from the treatment, while others either derive no advantage, or it is so slight that it does not exempt them from the pathological manifestations, which will therefore prove fatal to them.

Well, if we take the trouble to consider the facts which are inherent to the organization of the different individuals, we shall confirm what I have stated—that is to say, that those who have improved, either owing to the mitigation of their special morbidity or to the slackening or suppression of the progress of the pulmonary diseases, have a very different thorax to that of the others in whom the treatment has had no effect. The big thorax will have acquired greater respiratory capacity, thanks to the increased vigour of the muscles. Further, if we extend our examination to the heart, following the anatomical indications given by the maximal size of the above-mentioned intercostal spaces, we shall be able to reveal another important fact—namely, the increase of the mass of the heart; to which we can say is confided a large part in the maintenance of the conditions which were obtained by means of suitable hygiene.

Therefore, once more I feel it almost my duty to call the attention of the sanitary military authorities to this important particular, in order that they may be good enough to include among the criteria which they employ for the selection of recruits those which I have mentioned above. Moreover, having seen the physiological difference that may exist between chests having the same circumference in relationship with equal personal height, it is just that the different individual resistance and the different morbidity should be recognized.

That which I have said elsewhere I here repeat with the conscience of doing a useful thing. Many of the individuals selected have not the necessary resistance for supporting certain military duties. They are youths who attend to their work in the fields without any ill effects, but who, after the first marches, reveal their delicacy, and gradually fall into pulmonary consumption.

The measurements of the thorax give us the general idea of its capacity in relationship with the individual build ; nevertheless, our morphological conception will not be through this complete, if we do not add to it other data inherent to the shape of the chest, and others inherent to its function.

Many discrepancies between medical judgments and the physiological or pathological facts in the individual depend upon the inexact valuation of these deducible data, as I have said, and upon the form and function.

In the expressions *paralytic chest*, *barrel-chest*, and *chicken-breast* is implied a certain conception inherent to the function of the thorax ; but we, without ignoring these notions for what they are worth according to the teachings of experience, intend to reason otherwise, examining separately some skeletal peculiarities.

We shall begin with the clavicles. These offer variations as regards length, shape, level at which they are found, and the direction of the latter.

According to our custom, we reveal the facts, always proceeding with the comparative method. Two chests similar in form may present differences relative to the clavicles : short in one and longer in the other ; in the former the clavicles are horizontal from within outwards and slightly inclining from before backwards. By reason of this different direction of the clavicles, the two chests, or, to speak better, the equal thoracic capacities, appear different, because, being covered by the soft parts, they are usually considered very different from each other, and consequently one is inclined to attribute to one (that of the short clavicles) a given morbidity which is not recognized in the other, to which definite morbidity is even denied.

But this is contrary to the reality. The thorax, with the short clavicles sloping backwards on an ascending plane, appears almost projecting at the median line, is seen more or less contracted, especially above, and causes the suspicion readily to arise of a well-known morbid disposition, which experience teaches is very rarely dissociated from its anomaly of form. The other thorax, which has such a different appearance owing to the form and position of its clavicles, is not exempt from the morbidity which appertains to the former. The illusion generated by the clavicles ceases when one observes that its superior sagittal diameter is very short ; consequently the thorax, which seemed very big, is found to be compressed from before backwards. The clavicle, though long, only hides the insufficiency of the chest. This is proved by the fact that the axillary cavity is very large, and the shoulder-joint very distant from the top of the chest ; therefore the largeness of the thorax is only apparent. If we add that the sagittal diameter is, as we have said, shorter than normal, we can only conclude that both chests, apparently so different, end with being two types of the same morbidity, or, better, of the same kind of morbidity.

In fact, in some of my previous writings I have mentioned the coincidence of the flattened thorax with morbidity of the serosæ, especially of the respiratory apparatus, which subsequently declares itself with lymphatic or constitutional pleuritis, which may be associated with a morbid process—as a rule, chronic from the beginning—and which may end in tuberculosis.

In these two forms of the thorax two different modes of development of the heart are also met with. In the contracted chest, with relatively short clavicles, there is aplasia of the heart, especially of its left half ; in the flattened thorax the heart is asymmetrical, by virtue of the predomination of the right half. But in both the hydraulic conditions are analogous ; the pressure in the venous tree is greater, and the differences which are disclosed by the comparative examination of the general circulation in the two cases are relative *to the degree of aplasia of the arterial circulation, and to the greater or less development of the lymphatic system considered as a whole and in its various parts.* Naturally the morbid facts correspond to these conditions of morphological development of the circulatory apparatus.

The shape of the supra- and of the infraclavicular fossæ depend partly on that of the clavicles. As a rule, one can judge how much the respiratory expansion of the apex of the lung is wanting, from the greater or less depression of these fossæ. But it must be observed that in some persons the clavicle is curved upwards to an extent that its level is much higher in respect to that of the apex of the lung. By reason of this it happens not rarely that, although the fossæ are less depressed, the percussion note and the respiration in the regions are quite normal. It is all the more necessary to record these facts, because the alteration in shape of the clavicles above mentioned is frequently met with in individuals belonging to the type of the *First Combination.* Therefore it is necessary to mention here only that the morbid sign in question must not be accepted unless it is confirmed by auscultation and percussion.

Among the parts of the chest which we must examine are the first and second intercostal spaces. The wider these are in comparison with the other intercostal spaces, the more the thorax acquires an anomalous morphological character. I can maintain absolutely that to the greater width of the first and second intercostal spaces *correspond a greater length of the manubrium of the sternum and the relative condition of defective development of the left ventricle and of the aorta, which is consequently longer and narrower than normal ; and this condition is met with in individuals appertaining to the type of the First Combination.* I maintain likewise that *these conditions are never found in individuals belonging to the type of the Second Combination ;* and I add that *occasionally intercostal spaces are met with in adults which present characters of the type of the Third Combination, but they are individuals who, in the course of years, have been able to transform themselves.* With the anomaly of the first and second intercostal spaces are associated other anomalies which I shall speak of more opportunely further on.

To the chest is attributed a conical shape, and it is well ; but this does not tell us all that is necessary to know, for one requires everything which can be obtained from other particulars of form, which are of importance to the clinic, as we shall see.

In the thorax we must distinguish two parts : that which corresponds truly to the respiratory surfaces and extends to the level of the diaphragmatic hollow, and that which protends below, forming the roof of the abdominal cavity. This in normal chests constitutes what we shall call the basal part of the thoracic cone, and in consequence gradually enlarges to its lowest section, where it is slightly constricted in such a manner that the chest as a whole acquires its special form. Well, if we examine two or more chests belonging to the First, Second, and Third Combinations for the purpose of judging the differences which may exist between them as regards their basal part, we shall see that even those chests which may be considered equal as regards the part which we call respiratory may differ in the basal part according to whether this enlarges more or less, augmenting in proportion the transverse diameter of the abdominal cavity of which it forms the roof, or does not enlarge in the least and retains its cylindrical form.

One understands that this circumstance has some importance, for it indicates how certain physiological and pathological conditions relative to the respiratory apparatus and to the heart may be differently influenced by the greater or less development of the organs situated in the hypochondria. For this reason to the measurements which are generally taken for the scope of exercise and practical education has been added the measurement of the transverse diameter of the superior part of the belly surrounded by the thorax. This measurement, put constantly in relationship with the relative phenomena of organic development, enables us practically to comprehend the importance and value of the morphological estimate.

As I believe this particular has some practical and scientific utility, I wish to add that if we consider a number of individuals belonging to the same morphological combinations and examine the xipho-unbilical line, we shall immediately recognize that the morphological signification of this varies according to whether the transverse diameter of the superior section of the belly is maximum, normal, or minimum.

If up to now we have not considered these particulars from the biological and clinical points of view, it does not mean that the facts which they reveal are without importance. And I say this in reply to those who, instead of examining the scientific foundations and the practical method of our researches, have only troubled themselves to deny gratuitously everything at their medical meetings and in their scholastic lectures.

Other peculiarities of form are met with in the thorax as the result of anomalies of development, which occur during the process of ossification and of growth of the organism. I mention one which has acquired celebrity—namely, *Louis's angle,* which is seen especially in individuals of the First Combination, and with which I shall have to occupy myself later on.

At the base of the ensiform apophysis and around it is observed a depression or a true hollow more or less deep. In some cases it is so deep as to constitute the so-called *funnel-shaped thorax.*

In others it is a slight and simple depression of the thoracic surface, which extends laterally to a variable extent like a belt, but gradually disappears from the median line outwards. This limits more or less the confines of the part which I have called respiratory, and which is followed by the basal part of the thoracic cone.

In other cases both halves of the chest, though symmetrical as a whole, are not so in some part : either in the cardiac region, which may be raised or projecting, as is generally seen in cases of cardiopathy ; or the fifth and sixth ribs, which, while being attached to the sternum in the normal way, are curved outwards so that they project beyond the level of the thorax. These and other similar anomalies of form are met with in individuals in whom attributes, more or less clear, of the type of the First Combination are verified, and hence we must consider them as corresponding indications of morbidity.

We must mention the cases of supernumerary ribs. These take us back to the time in which the thorax had a greater extension than the actual, when the supernumerary ribs were found towards the neck or in the lumbar regions. I have described a case of malformation of the clavicle, but I must now correct the error which I then fell into, as it really treated of a supernumerary cervical rib. My observation dates back to the year 1867 (see *Giornale di Anatomia e Fisiologia patologica*, edited by Professor Sangalli, vol. iv., fasc. v., 1867, Milano). My error was due to inexperience and defective knowledge, but in those days our studies were not cultivated on the same lines as they are to-day ; for this reason it happened that my mistake was confirmed by my teacher. In fact, in a cadaver I saw two malformations—one in the valves of the heart and the other in the right clavicle, from whose shaft, a little internal to the centre, started a bony process of a calibre equal to about half that of the shaft, and which ascending, covered by the soft parts, was united to the cervical column inferiorly. This is conformable to what we know concerning the rudimentary parts in man, in whom the rudimentary cervical rib attached to the seventh cervical vertebra rarely reaches the sternum, and more frequently unites with the first pair of ribs by means of its cartilage.

The addition of a thirteenth rib is constantly met with in embryonic development, and also in the two successive lumbar vertebræ the vestige of a rib may be seen (Widersheim). And

Rosemberg has published a case of an adult in whom two lumbar ribs existed. I remember having met with casually a thirteenth rib in a consumptive patient, in whom the thoracic excursion observed behind offered some exceptional phenomena, of which it is not necessary here to speak. I also remember that in a case in which thirteen ribs existed on both sides, the left extremity of the base of the heart corresponded to the fourth, instead of to the third, rib.

What application can be made of these facts ? According to the principles of evolution, we must admit that all these errors of organization, which indicate atavic characters, represent indications of morbidity. Further experience and knowledge will define more clearly this vague conception.

Coming now to discuss the function of the chest, we must take into consideration simultaneously all the mechanical and dynamic factors which compose, and therefore modify, it.

The part of the thorax which presents the most important and frequent functional anomalies is that of the apices. In these, during ordinary respiration, one observes a thoracic expansion, generally limited as compared with the parts inferior to them. Again, during ordinary respiration one sees very slight muscular activity, and then the weak and thin pectoral muscles contrast with the belly of the sterno-cleido-mastoid projecting under the skin in strong lines, especially during deep inspiration. If we examine carefully how the thoracic expansion is fulfilled in deep inspirations, we see, still in the region of the apices, that instead of the chest being raised, as happens generally when its parts act independently one after another, all are raised together as if united into a single piece, while this does not occur from the third ribs downward.

These modes of thoracic excursion, which are not inherent to the altered functional capacity of the respiratory organ, are in relationship with special conditions of the skeleton. In fact, the mode of action of the thoracic region of the apex depends on the previous ossification of parts which one knows ought to possess the greatest mobility according to the requirements of the lungs. In these cases it is seen that the obstruction offered by the chest-wall to the expansion of the thorax has reduced proportionately the pulmonary ventilation, giving rise to the relative consequences in the circulation and in the exchange of gases. And all this is found in individuals who appertain to the type of the First Combination.

We see quite the opposite in those cases in which the superior region of the chest is very mobile. This occurs very rarely in individuals of the male sex, and about the age of puberty. It is found frequently in women when, to follow the requirements of a false æsthetics—the fashion—they begin to constrict the thorax in that kind of cuirass shaped so as to contract the trunk above the hips in order to make it as slender as possible. Thus, within this inelastic and strong corset strengthened by steel ribs, the expansion of the chest is impeded and the excursion of the diaphragm is limited, while the whole of the abdominal viscera, pushed by the powers of respiration and compressed by the corset, are gradually displaced downward, and weigh on the pelvic organs. I shall very briefly record here the injuries derived from this unhealthy fashion. The expansion of the inferior part of the chest being impeded, the superior part, owing to the internal pressure produced necessarily by the lungs, gradually becomes altered in its shape, so that the line of the sternum is raised, and consequently the thorax becomes projecting. The anatomists say that the chest of woman, different to that of the male, projects in its antero-superior part ; but this difference in reality cannot be attributed to sex, but to the habitude which women very early assume of imprisoning the thorax as we have said. The women who have never worn corsets do not present in the least the alteration in form of which we have spoken. In some cases it is so great that the sternum is arched. It is clear that the modification of form which the chest undergoes is a kind of compensation which the respiratory function obtains by reason of the impediment which is maintained inferiorly by the tightness of the corset.

It is, however, a very slight compensation, as can be verified by clinical pathology, because the respiratory function is never effected with its normal capacity, or because, especially in some cases, this thoracic deformity is followed by many other consequences in the dominion of other very important functions—namely, the circulatory, the digestive, and that of the genital organs—as we shall show elsewhere. Meanwhile I maintain that if in the normal chest, or, to speak better, in that not deformed by corsets, we distinguish, as a rule, the respiratory type into costal and diaphragmatic, to be consistent we must say that in the cases in question we have, or may have, the type of *sternal* respiration. In reality the maximal thoracic excursion is effected by the anterior and superior part of the chest. It is a type of respiration which resembles that of the frog.

We shall now take into consideration the mobility of another part—namely, the manubrium of the sternum.

As is known, the manubrium is united to the gladiolus by an amphiarthrodial joint. The articular surfaces are two flat rectangular facettes covered with cartilage. In some cases in the centre of this articulation exists a true articular cavity, when the joint is of the diarthrodial form.

The manubrium and the second piece of the sternum, by reason of the articulation which unites them, are capable of movement, which takes place during the respiratory excursions. Although these movements are, it is true, very limited, this does not prevent them having importance, as we shall see.

If we observe the thoracic excursion in an individual regular in every respect as regards the shape of the chest and the respiratory and muscular functions, we shall see that the inspiratory movement of the thorax begins above and then gradually extends downward ; the first to be raised are the first ribs, and the manubrium of the sternum, to which they are united.

Dr. Rothschild, of Frankfort-on-the-Maine, has instituted in my clinic a series of very rigorous observations by means of an instrument expressly invented and called sterno-goniometer.[1]

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[1] *Der Sternalwinkel* (*Angulus Lodovici*) *in anatomischer, physiologischer und pathologischer Hinschit v. Docr. David Rothschild.* Frankfort, 1900. It is an able monograph, the fruit of physiological and pathological researches devised by the author, who was aware of the mobility possessed by the superior part of the sternum in some cases. I have been able to verify many facts cited by the author, and especially those concerning patients suffering from, or predisposed to, pulmonary phthisis. I have also verified that the immobility of the sternum coincides with exceptional width of the first and second intercostal spaces.

According to what results from the researches carried out by the author in my clinic, it is not the *Angulus Lodovici* which deserves the greatest attention, because it may be found not only in consumption, but also in other morbid states, such as emphysema.

The projection of the angle and the complete ossification of the manubrium with the gladiolus of the sternum modify the shape of the chest, which in this region appears flattened, and given the coincidence of things, we add, not only flattened, but with the first and second intercostal spaces wider than normal, and given these two conditions, we can say, further, with the manubrium immobile.

We have mentioned these facts because it must not be thought that we believe the sterno-goniometer to be necessary for diagnostic purposes, while we think it an excellent instrument for study and clinical teaching.

With this instrument we have been able to convince ourselves of the reality of the sternal movement, which consists in a slight raising of the plane of the manubrium, during which the latter presses the part of the instrument which is applied there, and moves an index which marks on a quadrant the amount of the movement.

During the course of our observations we saw that the mobility of the sternum was not the same in every individual, and that in some it was very slight, and even nothing. And all this is in relationship with what we know as regards the anomalies of development and of ossification of the sternum. But that which is important for us is contained in the following propositions, in which we summarize what enables us to form the opinion which we have to express concerning the normal and abnormal mobility and expansion of the chest, especially in its superior part or that of the pulmonary apex. We can maintain—

(1) That when that deformity of the sternum which is known under the name of the *angle of Louis* exists, the mobility of the sternum is very slight or nothing; (2) that when the first two intercostal spaces are abnormally wide, the mobility of the sternum also reduces itself to nothing; (3) that in the cases in which the superior sagittal diameter of the chest is abnormally short, the mobility of the sternum may be normal, minimum, or nothing.

If we consider these conditions for a moment, we shall comprehend that the respiratory function of the pulmonary apex must be normal or not, according to the condition of mobility of the chest-wall.

If we next consider that the minor mobility is in relationship with the process of ossification of the parts which are normally articulated, we shall quickly see the importance of the fact which is met with in the young, in whom the process of ossification is not found, and in whom, therefore, for skeletal reasons, the respiratory function has had to modify itself in an injurious sense.

If we add that these anomalies are also observed in individuals who belong to the type of the First Morphological Combination, we shall understand more fully the importance of the anomalous fact, because, *cæterus paribus*, in proportion to its existence or not, our judgment is modified concerning the value of the other indications of morbidity on which our diagnostic considerations are usually based. In other words, in two individuals having the same thoracic capacity, the pulmonary respiration of the apex will be greater in him whose sternum moves more or moves normally, and *vice versa*. And we know that the less the excursion of the thorax, the less the movement of the hydraulic mass in the pulmonary tissue ; hence the reason owing to which the above-mentioned alterations of form and function of the chest are readily associated with conditions of altered circulation, and with a consequent disposition of the nutrition of the lungs to become changed.

From this one understands that if we carefully examine cases apparently equal, we shall find circumstances which differentiate them from one another. In fact, while the slight mobility of the chest at the apex is equal in all, we cannot say that the cause of the limited mobility is the same for all, if in some this is due to the precocious ossification of the skeletal parts which we have especially taken into consideration, and if in others it mainly depends upon weakness of the muscular function. One equally understands that from the verification of the two different modes of altered mobility of the chest one derives two different guides as to the treatment.

Up to here we have studied the signification of some alterations of form of the chest in relationship with its function, recognizing the alteration of form as an accomplished fact. But now we must occupy ourselves with the alteration of function of the chest, which gradually manifests itself as the progressive effect of the alteration in form of the thorax, also progressive, and of concomitant functional alterations of the muscles.

These facts always occur in young persons who have arrived at the age of puberty, when they become insensibly transformed, in consequence of their primary morphological type degenerating. They, indeed, begin to change their deportment, grow more or less quickly, but stoop forwards ; and if we recommend them to hold themselves upright, as they were accustomed to do previously, they immediately fall into the stooping position. When we look at them, it appears that the chest is hollowed anteriorly, that the shoulders are raised abnormally, and that the head cannot be held on the normal vertical axis of the body.

It is of great importance to recognize the morphological signification of these facts from their primary manifestation. They are said to be due, as a rule, to a bad habit; but it is not considered that the habit is precisely the effect of organic tendencies, which may be exaggerated by habit, but are, in reality, the cause of the new habit. In these individuals occurs a series of facts of great scientific and practical importance. In the period in which the complete ossification of the vertebræ normally takes place this does not happen, or it happens irregularly; for the centrum and the intervertebral discs acquire abnormal proportions, so that the vertebral column as a whole or in one of its parts—which in our case is, as a rule, the cervico-dorsal portion—is unduly lengthened. Together with these skeletal conditions, others are met with in the arterial and venous circulation of the spinal column and in the nervous system, and precisely in the nerves which escape from the intervertebral foramina of the above-mentioned portion of the column. These nerves are obliged to adapt themselves to the mechanical requirements of the vertebral column, which grows abnormally, and gradually find themselves in a descending plane, exaggerating in this manner a condition originally normal, but which, by reason of its proportions, has become pathological. And we have the first indications of it when we see the youth change his poses, habits, and deportment. By virtue of this kind of nervous disturbance, the functions of the nerves in question are modified in two ways: the motor functional power diminishes, and the excitability becomes exaggerated.

Meanwhile, in these individuals the muscles of the upper part of the chest do not contribute to the perfect equilibrium of the spinal column; they do not keep the scapulæ in their normal position fixed to the ribs; they do not assist as much as is necessary in the excursion of the superior part of the chest, and then begin the painful phenomena which very quickly are complicated by symptoms of altered innervation. Further, it must be known that all these changes, owing to which the primary morphological condition of the organism deteriorates, declare themselves with phenomena belonging to the sphere of nutrition and that of innervation, as results from the physiological histories more than from the pathological anamnesis referable to the special lung affections, which are taken into consideration almost exclusively in the ordinary anamnestic reports.

These are facts of ordinary observation, but which have never been systematized according to scientific conceptions, from which alone the practical criterion can be obtained. If, now, we accumulate all that which common experience has gathered, and submit it to the biological principle, which one must follow, as the function and organ mutually influence each other while the organism is evolving, it results that we must not only take note of the accomplished morphological facts, *but we must also take into consideration those which possibly are completing themselves.* This is a point of special value as regards the morphological doctrines, through which is presented to medicine the task of prophylaxis in its practical possibilities, but which must be ventilated in the special conditions of the individuals. In other parts of our treatise we shall verify the truth of these principles, which, to respond to the insinuations of those who have not appreciated the modern morphological doctrine, are anything but *dogmatic.*

I shall next speak of the motor function of the precordial region of the chest.

If we make the patient respire, and attentively observe the precordial region in a good and steady light, after having repeated the observation several times, we will perceive that the portion of the chest which conceals the heart does not move like all the other parts of the chest-walls during inspiration.

The long experience acquired by me in this kind of observation, and the care taken by me to be controlled by experts percussing the heart, have enabled me to define the cardiac mass by simple inspection of the precordial region, and, consequently, have given me the opportunity of knowing exactly how to inform myself with regard to the movement of the chest in the precordial region.

Besides, this fact is a corollary of a mathematical axiom, which says : *The line is a function.* Well, the lines of the chest, which during the inspiratory movement show us how the heart, owing to its presence and the continuity of its revolutions, requires the chest-walls to act, express to us the mechanical function exercised by the heart, as a mass, in the mobile environment of the chest.

At any rate, by careful observation of the cardiac region during the thoracic excursion we can mark the cardinal points of the cardiac triangle with a dermographic pencil. In some cases the movement of the thorax is performed in such a way that it is necessary to request the patient to make deep inspirations ; but

I believe that in such cases by this expedient the phenomenon of which I speak will be rendered evident to all who take up this question, even during the first observations. Nevertheless, I must admit there are cases in which the observation fails, because the movement of the chest is not effected normally, as occurs in emphysema, in extensive alterations of the respiratory apparatus, and in cases where the innervation deviates from its functional type. The same may be said for the cases in which the process of ossification of the skeletal parts is very advanced, and where the respiration is mainly abdominal.

The examination of the motor function of the chest has also much importance by virtue of the fact that, like every other organic function, it becomes modified by physiological and pathological causes, and therefore constitutes a mechanical criterion useful for explaining phenomena inherent to the circulation and respiration, besides the consequent facts inherent to the functions of the different organs. The heart necessarily responds to the movements of the chest, with functional acts determined by the play of the physiological correlations according to its primitive development. In fact, in some individuals certain respiratory modifications, even unnoticed, are followed by modifications of the cardiac function, and these alone are observed. Then follow hydraulic phenomena, more readily in the cerebral centres, or in the spinal centres, or in the portal circulation, or in the arterial, and there are corresponding phenomena more or less temporary or persistent according to the cases and to the individual predisposition.

If we investigate the physiological anamnesis of every individual, we shall be able to establish that certain manifestations, which generally pass unobserved, and which constitute what is called idiosyncrasy, or the special kind of individual feeling, in the continuity of the cause—which in our case is precisely definite alterations of the circulation secondary to the changed respiratory type—gradually become more frequent and more intense than usual, and finally acquire the appearance of distinctly morbid phenomena, with which initiate diseases of one or another part of the organism.

The clinical observations of those suffering from hysteria, hypochondria, piles, as well as of those predisposed to passive and active cerebral congestions, etc., demonstrate in what I would call an absolutely experimental way the truth of what I have said. Hence the precept, truly practical in my opinion, of never forgetting to verify the manner in which the respiratory function is usually performed and altered when we have to register the course of the morbid symptoms. All these things acquire further importance from what to-day is proposed for modifying with a therapeutic scope the endo-cardiac circulation by means of the respiratory function.

The mobility of the chest may be modified as a whole through causes of innervation, or through one or another cause together. This produces, naturally, consequences in the thoracic capacity : the lungs expand less ; by reason of the general wasting which for a long time has occurred in the biochemical process subordinate to the function of the oxygen and the elimination of the carbonic acid, the blood-mass diminishes ; the chest adapts itself to the changed conditions of the lungs, which have diminished in size, so that it gradually becomes lessened in its circumference. *In this consists one of the modes of morphological deterioration by virtue of which the morbidities become apparent which before were not even suspected.*

Having mentioned wasting as a cause of the modification of the morphological lines of the chest, it is natural to maintain that one can verify this condition, and consequently the reduction of the subcutaneous connective tissue and that of the muscular masses. But this is not the general rule. I am certain that one can see the periphery of the thorax reduced a centimetre, and even more, before the wasting of the tissues can be verified.

The cause of this is as follows : The musculature of the chest, like that of the other parts, has lost its pristine functional energy ; therefore the inspiratory excursion has become less, and, in consequence, the posture of the chest is equivalent to its diminution.

We shall now describe another kind of movement of the chest. I have seen individuals who had a thorax with a very long sternum (exceeding the normal measurement for them by 12 or more per cent.), and in whom the thoracic movement differed from the normal as follows : In the inspiratory act all the part which corresponded precisely to the respiratory surface moved well, while the subjacent part remained almost immobile. We know, on the contrary, that the whole of the chest-wall is elevated during the act of inspiration, and that that part which corresponds to the hypochondria also expands. In these individuals, making all the examinations required by the morphological method, we observe that the type of respiration is exclusively or mainly thoracic ; that the central tendon is found high, the vault of the diaphragm being more raised and the diaphragmatic hollow deeper than normal. The heart in these cases is not seen to beat in the fifth intercostal space, and is not felt, or is barely felt. On the other hand, we may see a slight rhythmic movement in the sixth intercostal space, where the pulsation of the apex is erroneously supposed to be. In some pathological cases this transposition of the impulse of the cardiac beat was so strong that it made one believe that the apex reached the seventh intercostal space, and here one felt by palpation a corresponding thud which was not felt in the fifth or sixth intercostal space. But the cause of this is due to the fact that in this morphological condition of the thorax the heart does not strike the chest ; its movements are felt on the diaphragm, which transmits them to the underlying abdominal space. During life the heart was confined within its ordinary limits, thus excluding that degree of hypertrophy which, according to the inspection and to palpation of the beats, ought to have been admitted. The autopsy verified the exactness of the diagnosis made during life.

III. Anamnestic Examination.

The anamnesis is commonly made with the object of knowing the heredity of the individual, previous diseases, the origin and the course of the present disease.

But, according to the requirements of the more strictly naturalistic method, the anamnestic examination must include other particulars ; for if it is important to know the previous diseases, and everything which concerns the actual disease, we must not neglect all that which can contribute to the knowledge of the individuality.

To comprehend the importance of this, it is necessary for us to remember that the instincts, certain habits, certain attitudes, idiosyncrasies, many manifestations of life which, being special to the individual, pass unobserved, are to be referred to the efficiency of special morphological conditions.

While the explanation of the instincts, habits, corporeal attitudes, and so on, leads the mind to consider definite morphological conditions, one succeeds in discovering interesting etiological factors which very frequently pass unobserved, and one more readily goes in quest of the morbid causes outside the body, in which we find more rarely than is thought the true causes, the circumstances inculpated being only accidental coincidences or quite secondary causes.

The principle established by us that *the cause of the special morbidity of the individual resides in his special morphology* has to be always present to our mind, even during the anamnestic researches. Thus acting, in the functions of the organs and of the organisms we shall be able to trace the indications of the morphological dispositions by which the individuality is declared.

For the further confirmation of these things, however, it is well to remember those cases in which have been clearly demonstrated not only the dependence of the functions on special morphology, but also the consequence of a relative or absolute morbidity from the exercise of that function which in the concrete case will be an instinct, or a habit, or a particular idiosyncrasy, when it is not a necessity of occupational life.

One must recognize that this kind of research presents no slight difficulties regarding both the science and the individuals. It is not everyone who knows that which he must seek. All individuals are not equally intelligent, nor are they equally mindful of the circumstances which they have to investigate. On the other hand, it is hardly possible to obtain the truthful account of the facts concerning the morbid tendencies of families.

1. *Notes on the Criterion of Inheritance.*

According to the teaching of natural history, in the laws of heredity should be found very important criteria for judging the mode of life of the individual ; but in reality these laws, on the one hand, are as yet little known, and, on the other, physicians in the research of inheritance do not make use of that fine criticism without which the research is either quite useless or injurious to the task undertaken.[1]

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[1] In my opinion the method by which one proceeds to the research and application of the criterion of heredity must be different from what it has been up to now. One very frequently writes : "*Nothing inherited,*" or "*Relatives healthy,*"

With regard to the insufficiency of our knowledge of the laws of heredity, I wish that the books of pathology would not limit themselves to those few assertions destined to show the possibility of the transmission from parents to offspring of morbid dispositions, but would discuss from the results of experience the grave argument of the *variability* of heredity itself.[1]

I shall certainly not enter into the theoretical question, as it would take me away from my task ; still, I must refer to the innumerable causes which influence the evolution of the human germ, to the very many kinds of adaptation, owing to which on the fundamental law of heredity are effected infinite variations of the morphological type, with the relative morbid dispositions.

Passing by the disputes still undecided concerning the part played by the ovule and by the sperm as regards the prevalence of the one or the other—the influence of artificial factors, emotions, etc.—it is certain that the descent of living things is effected in a way that very frequently it is difficult to recognize the offspring as the work of the parents. And then, if we do not consider that heredity is an incontrovertible law, we can with Louis deny even to-day that there is an inheritance of diseases and of morbid dispositions, or, with the majority of physicians, admit it only where it is effected in certain ways, denying it or neglecting it when it is modified in certain others.

But, on the other hand, we must admit that an inheritance in the concrete case has been effected, and we must establish in what

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or "*Father* (or mother or brother) . . . *dead of tuberculosis, cerebral apoplexy,* or *cancer* "; and with this, not rarely simply asserted and not proved, is established the hereditary criterion which in due time will be made use of. Later it becomes known that the relations, though healthy, had special morbid disposition, consequently that "*Nothing inherited*" is nonsense ; or it is discovered that the maladies from which the relatives died were different from those referred to, etc. Meanwhile, the false notion prejudices the interpretation of the morbid symptoms, and preoccupies the mind in the prognosis. At other times it happens that the idea concerning inheritance is true, while its systematic application is wrong, as we shall see farther on in the text.

[1] I would advise the reader who desires to know the most important facts regarding the question of heredity to consult the following works :

Roth, E., *Die Thatsachen der Vererbung in geschichtlich-kritischer Darstellung.* 2e umgearb. Aufl. Berlin, 1885.

Ziegler, E., *Konnen erworbene pathologische Eigenschaften vererbt werden und wie entstehen erbliche Krankeiten und Missbildungen?* Jena, 1886 (reprinted from the *Beiträgen z. Patholog. Anat. u. Physiolg.*, and published by the author).

Yves Delage, *La structure du protoplasma et le théories sur l'hérédité et les grands problèmes de la biologie générale.* Paris, 1895.

manner the disease and morbid disposition have been modified by it.

For the present this highly scientific task is not possible. Nevertheless, trying to determine in the concrete case the conception of the individuality for our applications to the requirements of practice, we obtain subsidies of undoubted value—experience and the accomplished fact in the morphological type of the individual under examination.

Experience, which every day shows us how, for example, certain morbid dispositions of the parents generate certain other dispositions in the children, justifies what we have said. The science cannot yet discuss this fact, but experience shows it to us, and the clinic, *modifying its method of investigation according to the criterion of morphology, in the accomplished fact which the individual presents, recognizes the result of the hereditary variations,* and values it for its necessary applications to the diagnosis and prognosis, even independently from the exact notion of the genealogy.

In this, as is seen, is manifested once more the advantage gained from modern science by clinical medicine, so that the criterion of heredity will be more skilfully adopted in proportion to the accumulation of experience, which will enable us to see the substitutions of the morbid types, the immunity from, and the variability of the morbid dispositions.

The mystery of generation, notwithstanding the recent embryological studies, notwithstanding the modern naturalistic doctrines, is still what it was—very obscure. The first evolutions of the ovum are undecipherable acts, are the stages of primordial development of a future tuberculotic, epileptic, cancerous, or gouty individual, or of a perfect physiological type. But who can say in reality what it will be ? Who can recognize in it the influence of the male or of the female ? Who can recognize in it the influence which has modified the parents before its generation ? Who can discover in it the primary aberration through which the future being will be perhaps of the slender type, or imbecile, or monstrous ? Further, when the fœtus is born, will it be of normal development, the promoter of health, or will it present itself as a tiny being which appears as if it must succumb to the first inclemencies of the environment ? In spite of this, it frequently happens that the destinies of the new-born infant are different: the weakness and slenderness are substituted by robustness and resistance.

Sometimes the infant has somatic characters which betray the morbid predisposition, which, however, manifest themselves much later when the symptoms of the malady which killed one or other of the parents begin. I believe with Gegenbaur that one will understand *heredity* thoroughly, studying the growth of the individual, and I agree with Turner, who observes that to the idea of heredity is associated that of variability—that is to say, the appearance of certain characters different from those of the parents. This author refers to another communication of his,[1] read at the Annual Meeting of the British Association, held in Birmingham in 1865, in which he gave a series of examples of variations in structure met with in cadavers, owing to which he concluded that, in the development of every individual, *both in the intimate structure and in the external form*, there is a morphological specialization which produces distinctive characters. Consequently the structural individuality of each person is the expression of the sum of the individual variations of all the parts of his organism.

At other times it is only when the individual is traversing one or another of the different phases of development that the morphological attributes, by which is revealed the dreaded or unsuspected morbid predisposition, declare themselves.

All this means that the morbid disposition is centred in the morphological conditions of the individual; and inasmuch as the latter is transformed incessantly, it happens that the predisposition remains latent, or displays itself morbidly during one phase or another of development according to the cases.

For this reason I believe that the notion concerning the heredity of an individual must not force our judgment, unless we can corroborate it with the determination of the individual morphological type.

From this it appears that the application of our method can not only supply the eventual absence of the hereditary criterion, as I have said above, but *can guide us in making the application of the said criterion when its existence is verified.* For example, if we know that the grandfather or the mother of Tizius died tuberculotic, or from hepatic cirrhosis, we must not through this alone consider tuberculosis or hepatic cirrhosis probable at the first pulmonary or hepatic symptoms exhibited by him ; but we can consider that definite event more or less probable as we gradually verify individual morphological attributes referable to the individual morbid dispositions, so that the idea of inheritance comes from these attributes, or is supposed or demonstrated. The more they are accentuated in one direction or another, the more the diagnosis and prognosis will be confirmed.[1]

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[1] Turner, "L'Hérédité" (*Revue scientifique*, November 5, 1890).

These considerations are the more opportune the more we appreciate the natural fact of evolution in the organisms whose physiological conditions and morbid dispositions are transformed or modified during growth and the other phases of life.

The growth of the human body takes place according to rules dictated by the anthropologists, and which are briefly described in books of anatomy. But as regards these rules, which are also considered laws, we must have the same conception that we mentioned for the averages. There are, it is true, some cases which are faithful representatives of these laws, but the majority are exceptions. All that which the clinic has verified concerning the *crisis of development* speaks in favour of what I maintain, and it is a contribution of the clinic to biology, whatever the academicians, who include us among the pure practitioners, say ; it will be an academic kick, but it is a kick at the bucket from which they obtain some sips of scientific inspiration.

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[1] It is not according to the nature of this work to discuss the modern theories of heredity ; nevertheless, I must state that if we place each one of these under the control of the clinical facts, I think we shall find that each contains a particle of truth, but none of them a sufficient amount for the full explanation of the facts.

The theory of pangenesis of Darwin (*De la variation des Espèces*) I believe specially tends to explain the perpetuation of the anatomical elements. That of pangenesis of Haeckel (*Essais de Psycologie cellulaire*), more refined and conformable to the concepts of evolution, explains with probability the transmission of the vital phenomena epilogized in the undulatory movement of the plastidules —*l'hérédité est la transmission du mouvement des plastidules*—explains the variability of heredity—*l'adaptation est une modification du mouvement des plastidules, grâce à laquelle les plastidules acquièrent des propriétés nouvelles*—and explains also the *inheritance of the variations* recognized by Lamark, verifiable experimentally in animals and likewise in man.

But if the Haeckelian theory demonstrates the way in which heredity is effected, it does not inform us how a single cell of the body can concentrate in itself the individualities of an organism, physical and psychical individualities. Weismann has conceived another theory which is called that of *germinal continuity* (*Die Continuität des Keimplasma's als Grundlage einer Theorie der Vererbung*). According to this author, heredity takes place by means of a specific substance, which possesses special chemical and molecular properties, a very subtile substance which is transmitted unaltered from generation to generation. A part of this substance transmitted to the new organism does not take part in the work of production, but is reserved unchanged for the formation of the germ cells of the new organism. It is certain that thus is explained the continuity of the *germ-plasm.* During the act of fecundation the germ-plasm of both parents unites and passes to the children ; the residue which exists in these passes to the grandchildren, and thus one comprehends clearly the transmission also of the characters of the grandparents. However, in proportion to the multiplication of the generations the portion of the germ-plasm of the grandparents diminishes ; hence one can explain the progressive modification of the family types. But the part of the plasm transmitted, though reduced to the minimum, may be restored passing through later generations, and when this occurs the atavic phenomena may take place.

The importance of this theory is such that it will attract the attention of workers and thinkers for a long time.

It is a law, for example, that when the respiratory function begins, atrophy of the thymus gland follows. But are there not many exceptions to this rule ? And are not the exceptions numerous which are met with daily in the development of the vascular and nervous systems ?

We must set aside the law owing to which the new-born infant, measuring 50 centimetres in length, in ten months only has reached proportions 1,000 times greater than those which it had at birth, and owing to which the new-born infant, weighing about 3,000 grammes, shows an increase of 1,000,000,000 times the weight of the germ, while the adult at twenty-five years, as a rule, will have increased only twenty times the weight which he had when born. All this means that after birth the energy of growth progressively diminishes from year to year till the fiftieth year of life.

But, however correct may be this law of Quetelet, it is too generic to be employed for our purpose. We require to know whether the process of growth takes place regularly or not ; we require data which refer not only to the organism as a whole, but also to the parts which constitute it. Further, even if those relations of length and weight which are attributed to the different ages exist, we are not certain of the individual proportions of the physiological harmony between all.

By this I mean the laws of anatomical correlation, by virtue of which the size and weight of the parts of the body must represent a harmonic and possibly perfect whole, while the great individual variation demonstrates that this law of correlation in the function of adaptation lends itself to a thousand forms of different organic requirements.

And while these individual phenomena of the evolution of the human organism are constituting themselves, why is it that to me, a clinician, is imposed unconditionally an experimental result, elaborated in a laboratory, even though it is sent out from the laboratory with all the solemnity of scientific determinism? Why is it that the naturalistic observation of the clinician has not been, owing to its value and importance, included among the scientific documents consulted even by those who, dealing with animals alone, have monopolized the biological universe? But is not the discovery of the process of the method by which one has succeeded in verifying the biological value of the individual scientific?

The academicians (I call them "academicians" because, according to their way, they have made known that the epithet of "colleague" is not suitable)—the academicians will not demean themselves by accepting these stupid things. Then there are those who, posing as reforming geniuses, let fly a smile of compassion; and others who, from the olympus of the hypercritical criticism of which they seem specialists, qualify these things in the presence of the credulous public as works of magic, because they do not desire to comprehend them.

In spite of all this, it does not appear to me to be unworthy of the science, and I believe it necessary for practice to continue my researches, which are barely naturalistic.

The difference in growth of the different parts of the body, on the one hand, is the cause of difference in function on the other; it deals with difference in the age, volume, and quantity of the tissues. Inasmuch as every organ is composed not of a single histological element, but of various elements associated with one another, it is readily understood that from the different mode of growth must come different kinds of function, according to whether in the union of the organs the one or the other elements prevail.

From this we see how valuable the application of the morphological method is for the study of clinical pathology, because, from the morphological error, and from the functional variant derived from it, we are enabled to recognize the state of the intimate organization of the organs.

What we have said of the growth equally applies to the tendency of the organism to diminish or to become old. It is said that the weight of the body begins to diminish when the period of growth has finished, or, to speak better, the stationary period, at fifty years. But can he who knows how varied the period of growth is, foresee when, how, and where the decadence of the organism will declare itself and be effected ?

Muehlmann maintains, on the basis of his own observations, that the lungs may grow up to old age. The same is said of the epidermis ; and Kölliker has met with, in a man of sixty years, a new production of hair. Many authors speak of the long duration of the mucosæ, because their growth continues during life. The lungs also, according to the researches of Benecke and of Wesener, may continue their development till old age, excluding the pathological cases of emphysema, as results from the work of Muehlmann. It appears that the liver, on the contrary, is destined to early decadence, perhaps because the causes which affect it, and which in many ways may damage its functions, are very numerous. In this connection it is sufficient to mention all the functional processes, and consequently the morbid processes, in which it takes a direct or indirect part, owing to biochemical reasons, or to dynamic or nervous ones, or to the insufficient development of the circulatory system.

With regard to the kidneys, on the basis of numerous researches of many workers, including Boud, Thoma, and Vierord, we know that they may increase in size and weight up to twenty or thirty years, and that relatively to the organism the growth of the kidneys ceases first.

Concerning the spleen and the lymphatic system, we have not very accurate data ; but if I can judge from several clinical observations, I am induced to believe that these parts also rarely present phenomena of growth beyond adult age. As regards the vascular system, very numerous observations have been made, and we have positive data that its growth may take place even beyond adult age.

We cannot, therefore, guide ourselves among the difficulties of the clinic, always new, by means of the general rules above mentioned, nor will the systematic ideas of anatomy and physiology always aid us. Hence it is of the highest importance for us to trust ourselves to the fundamental criteria of morphology, and to persist in the study of the method for the application of the known laws and for the discovery of those still unknown.

2. *Functional Attitudes of the Nervous System.*

The aggregate of parts constituting our organism is unified by the nervous system; but this does not fully explain its high biological importance.

The nervous system, as physio-pathological observation demonstrates at every step, shares in the intimate union of the tissues of every organ, and concurs in the functional progress of each.

The agreement which exists between these conceptions, verified by pathological observation and what general anatomy and physiology—that is, morphology—teach, is wonderful.

From the procedure of some biological phenomena in the different tissues, especially in those most differentiated, such as the glandular cells of the liver, the cells of the peptic glands, the muscular fibres, etc., one is induced to admit that from the nerve emanates directly an impulse, a molecular movement, which integrates that by which we see the phenomena of exchange effected, consequently the trophic and secretory functions.

These conceptions do not belong to any system whatever; they are the legitimate and necessary emanation of clinical observation, where very frequently recurs the fact by which the altered function of the nerve is followed by an alteration of the trophism. From clinical observation—which, whether it be admitted or not, is always biological observation possessing the importance and value of experimental observation—one is also induced to admit that the influence of the nerve varies with the variation of the individual morphological conditions. This, naturally, diminishes the absolute value of the results obtained by experimental physiology and pathology. Further, we are convinced that the more the animals employed for experiment depart from the human type, the greater must be our reserve when we desire to make application of them to human pathology.

The biological fact is a necessary emanation of the morphological fact; we therefore can say that *the influence of the nerve on the tissues is what it must be according to the intimate structure and association of these.* Profound psychic pathema may alter the peptic secretion, or the gastric mobility, or the hepatic function, but the same pathema may not produce any of these phenomena; consequently we can admit that *the mode of action* *of the nervous system depends exclusively upon the individual morphological type.* Therefore *the individual morphological conception must consist of, besides the other elements, those which are derived from the examination of the special attitudes of the nervous system.*

According to experience, the programme for the examination of the nervous system, which, in my opinion, corresponds to our greatest requirements, is as follows :

1. To obtain indications from all the morphological data which reveal some error of evolution in the organism in relationship with the corresponding error in the evolution of the nervous system.
2. To note and value the functional anomalies of the nervous system during the individual development in the sphere of the cerebral, spinal, and sympathetic innervation.
3. To register whether there exist special phenomena referable to the metamera of the cerebro-spinal axis.
4. To note those phenomena which may have some comparison with those of individuals of another race, and eventually with those of the lower vertebrata.

Experience teaches us that, owing to the general mode of functioning of the nervous system, individuals can be distinguished into three categories—namely, *normal*, *erethistic*, and *torpid.*

It also teaches us that these functional qualities of the nervous system may be observed in the same individual differently associated : in one part he may be normal, in another erethistic, and in a third torpid. Then we have the irregular nervous type. In these cases the doctrine of the metamera will be specially referred to.

Since the normal morphological type is an ideal which one comprehends, but which is rarely, if ever, met with in its perfection, we shall see in every individual some functional peculiarity of the nervous system.

Early clinical observation on the coincidence of lymphatism and *neurosis* has perceived the relations which, through aberration of the process of organization, constitute themselves between the different anatomical components of the nervous organs. With this I wish to indicate another factor of the morphological examination, not less important than the others ; I mean that by which we must form a conception, possibly exact, of the conditions of development and of function of the circulatory apparatus in the nervous system.

No one can fail to recognize the importance of this factor in our morphological investigation when he thinks of the intimate relationship which subsists between the blood circulation and the functional capacity of the organ, besides the different mode of behaviour of the circulatory system in organs of different morphological types. It is surprising that before now clinical researches have not been instituted regarding this important argument, which includes questions relative to morbid dispositions, in consequence questions of pathogenesis and of therapeutics, and, I believe I am not mistaken in saying, questions of hygiene and of prophylaxis.

Here I shall simply maintain that, when we know the conditions of general development of the circulatory system, we have valuable indications for judging the state of the circulation of the nerve centres and of the peripheral nerves; and it is by this means that we can understand what has been previously said concerning the relations between *lymphatism* and *neurosis*, and that we can appreciate once more the great service derived from morphology by the clinic. In fact, I have never verified an anomaly of development or of function of the heart without asking myself, What consequence may this produce on the functional capacity of the nervous system? What relations exist between a given circulatory anomaly and the functional capacity of the nerves? And if we find anomalies of peripheral vascular development, carefully verifying the relations of anatomical correlation between the arteries, veins, and lymphatics, as I have said elsewhere, the question presents itself to us if, as in the skin, similar anomalies of vascular development can or must be admitted in the *spinal cord*.

Hence we see that it is scientifically, not theoretically, necessary to investigate all the biological manifestations of the individuals in order to acquire, through them, the most exact idea of the organization of the nerve centres.

Systematic anatomical knowledge regarding the distribution of the vessels in the nervous system is not sufficient, inasmuch as it is necessary to know if in the general case we have one of the many varieties, either in number, size, or seat, or, finally, in the predomination of the arteries, or of the veins, or of the lymphatics, always bearing in mind that the lymphatic circulation is united more or less closely, so to speak, with the special environment of the nerve.

Much remains to be done to improve our method of morphological investigation concerning this argument ; nevertheless, from the conquests already made we can augur well for the future. In another place I shall show the advantage which can be obtained from the conceptions just expounded.

3. *Brief Considerations on Instinct, Habits, and Idiosyncrásy.*

Instincts, habits, and idiosyncrasies are vital phenomena which have for a long time attracted the attention of naturalists and physiologists, but not that of the pathologists.

Very often, when hearing the anamnesis spontaneously given by intelligent persons, I have felt the desire of having the explanation of the phenomena which refer to instincts, habits, or idiosyncrasies, because they coincided with the principal morbid facts.

At other times I have observed that with the morbid dispositions were hereditarily acquired the idiosyncrasies, habits, or instincts of the parents ; while other times in the children these phenomena were suspended, or were modified with the morbidities.

Every physician can give examples of individuals who have lost or who have acquired instincts, habits, or idiosyncrasies towards the beginning of a disease or at its resolution.

We, therefore, who in the phenomenal expressions of the organisms search for the indications for recognizing better the organic or morphological conditions, can understand the importance which the clinical investigations regarding this argument will acquire. For this reason I believe it will be useful to dwell a little on this subject—at least, to explain the scientific conception which must direct our investigations.

With regard to *instinct*, it is known that an altogether gratuitous conception is generally attributed to this word ; it would seem almost a guide which unconsciously directs the actions of animals, and which would take the place of reason. Lamarck says, on the contrary, that instinct is a tendency provoked by felt necessities to definite actions, which correspond to these.

Darwin makes the function of instinct enter into the origin of species. According to him, instincts are habits which, generated by natural or artificial selection and by adaptation, are transmitted to the descendants.

In my opinion, the conception of Lamarck and that of Darwin complete one another, in the sense that the felt necessities and the corresponding definite actions create those habits which influence the functions of the parts of the organism and their adaptation, whose final result may become a transformation of the being. Be this as it may, instinct, considered in the primary sensation of a necessity, and in the possible final morphological modification, is a function united to definite morphological conditions, in which may be included a special morbidity, or at least the cause of abnormal functional capacities that may lead to morbid manifestations.

From the above facts one understands that the origin of some *habits* may be said to be instinctive ; but it is not these which are of chief interest to us, but *those others* which depend exclusively upon the erroneous or vicious conduct of the individual.

The former cannot easily be checked without the patient feeling some injurious effects ; the latter, on the contrary, must be combated, for they more directly lead to disease. In some persons, for example, the sexual habit is the effect of an organic need ; in others it is the consequence of an artifice, which may lead to the exceptional demand for the repetition of the sexual act, or to its suppression.

When, therefore, we take into consideration the habits of an individual, we must do so under the dual aspect of their origin first, and then of their morbid efficiency.

Both may equally contribute to morbid manifestations, when the instinctive habits become excessive. This is very easy, for man tends, as a rule, to exaggeration in satisfying his special desires when they give him pleasure, which he loves to repeat or prolong. I could quote examples in abundance if the matter was not of ordinary experience, so that it is sufficient to have mentioned the importance which must be connected with the research of the individual habits in order that everyone in practice will know how to adjust the research and its interpretation to the requirements of the method which we recommend.

I deem it necessary, also, to dwell a little on *idiosyncrasy*, or, better, *idiosyncrasies*, because the fact which is indicated by this expression—which in reality is not the most appropriate[1]—has to be recognized not only in those definite cases which have served for the classic physiological description of idiosyncrasy, but likewise in numerous cases where the same fact takes place and acts undoubtedly as a pathogenic element.

Up to now I have not seen others treat of idiosyncrasy from this point of view. The books of pathology, from the biggest to the smallest, repeat what is said in the books of physiology.

I therefore shall begin with giving a definition of idiosyncrasy, considering it from the pathological standpoint: it is *that special attitude of the nervous system through which the reflex acts* ab interno *or* ab externo *are effected in such a way that they give rise to phenomena which must be considered as true morbid acts.*[2]

From this definition it appears that idiosyncrasy is considered almost as a morbid disposition, by virtue of which the common external causes become morbific, which in the concrete case are in the habit of offending in that given way the sentient nervous apparatus.

Idiosyncrasies are *congenital* (*innate* of Bernard) and *acquired.* The former are, one may say, an attribute of nervous individuals. The others are met with, or may be met with, in all individuals, owing to the action of different causes which damage the nervous system.

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[1] This word is of ancient date, when the doctrines of *crasis* predominated, and from them was derived the explanation of everything: *ἴδιος*, *peculiar*; *σύνκρᾶσις*, *mixture*—the individual disposition to become ill, and also the special mode of feeling and reacting in the presence of definite stimuli. Nowadays the physiologists and pathologists, by common accord, have reserved the word for signifying a peculiar manner of reacting of the nervous system to certain stimuli. This explains sufficiently clearly the idea how the idiosyncratic phenomena manifest themselves; the nerves of a given part of the body are *hyperexcitable* to a given stimulant, or are altogether *non-excitable*; consequently, following their stimulation by the work of that given stimulus, several reflex acts may take place, which present themselves with symptoms of hyperæsthesia or anæsthesia of hyper- or acinesia, of hypercrinia, etc. Further, it is necessary to note that in the most peculiar facts of idiosyncrasy there are, as a rule, an exceptional concatination of phenomena; for example, in some persons the introduction of certain substances into the stomach generally produces not only vomiting, but also amblyopia; in others cold at the extremities is not felt subjectively, but invariably generates visceral phenomena.

[2] I have given a similar definition in 1876 in my book, *Patologia del simpatico*, where I have also given explanatory clinical observations, which I cannot reproduce here, and have made a distinction of idiosyncrasies which I reproduce in the text somewhat modified.

The congenital, or innate, are increased by special dyscrasial conditions, in the same manner that these may determine acquired idiosyncrasies, which last as long as the dyscrasial conditions themselves.

All know that oligæmia, uricæmia, uræmia, set up a modification in the condition of the nerves, in virtue of which the patients suffering from these affections present a special nervous susceptibility or special idiosyncratic forms. To-day we can add that special idiosyncratic forms are determined by the presence of *ptomaines* or *toxins* in the blood in all cases of infection of the organism, when these toxic substances are of a nature to influence in a characteristic mode the nervous system.

Other causes still may modify the functional state of the nervous system in a more or less permanent or a more or less temporary way. These are, as a rule, excesses of work of the whole organism or of some of its parts. In reality, everyone knows the greater vulnerability which the body in a state of exhaustion presents, either owing to abuse of a nervous function proper or to excess of some functional disorder or other induced especially in the abdominal viscera.

For the above reasons, idiosyncrasies must be distinguished into the *constant* and *transitory*, according to whether the anomaly of nervous function is kept up by durable causes, as a constant dyscrasia, a general nervous exhaustion as the final consequence of protracted abuse, or by a temporary cause, such as fatigue of the organism through protracted muscular work, or a disorder of one of the abdominal viscera.

Further idiosyncrasies are divided into *cerebral*, *spinal*, and *ganglionic*, according to whether the phenomena with which they present themselves require by preference the intervention of one or another section of the nervous system.

And, finally, they are distinguished into *general* and *partial*.

Now I shall indicate briefly how the acquired idiosyncrasies arise, admitting that, with regard to the congenital, the cause is attributed to the irregular evolution of the nervous system and to its weak nutrition.

Every time that the blood-crasis, or even only the blood circulation in the nerve centres, becomes altered, a nutritive and consequently a functional disturbance takes place in these. Hence the ancient aphorism which says *Sanguis moderator nervorum* is always applicable.

If we consider the idiosyncrasies from nervous exhaustion, there appears also an analogous causal fact—the denutrition of the nerve elements—to which we wish to add the vasomotor anomalies which may occur in the exhausted nerve centre.

With regard to the other idiosyncrasies which we subordinate to visceral influences, we will mention that sometimes these are exercised in such a way that the segment of the nerve centre relative to the viscera is stimulated and affected by vasomotor phenomena according to the cases, through which the excitability in the above-mentioned nerve centre is modified.

It is not necessary for me to dwell further on this question, now that the function of sensibility has contributed so much to the interpretation of biological facts, and that the doctrine of the reflexes is so generally and extensively applied ; therefore I can congratulate myself on the general classification of reflex phenomena into reflexes *ab externo* and reflexes *ab interno* which I have adopted since 1876, and have deduced from clinical observation. Here I wish to refer to what I have described regarding the nervous system and the way in which it should be investigated by the clinician with the intent of contributing to anthropology and to the knowledge of the individuality for the advantage of the clinic.

By reason of these brief considerations on heredity, instincts, habits, and idiosyncrasies, I believe that one will readily comprehend the great importance of an accurate anamnesis, which aims not only at obtaining the facts concerning the previous morbid states and all that which indicates the beginning and development of the actual disease, but—harmonizing them with the morphological researches regarding the habits, instincts, idiosyncrasies, etc.—also at discovering all those circumstances and physiological factors which have contributed to the disease or to its special form.

It is necessary that practitioners should convince themselves that the time has passed in which a patient was examined for revealing a definite morbid picture, comparing it with a definite nosographical description. They must have not only the knowledge of special medical pathology, but also the habit of noting all the physiological and symptomatic phenomena which the patient presents, to conceive an exact idea of his case. His special morphological combination, recognized either by the examination of the form and proportions of the body or by means of physiological researches, will give a clearer conception of the case, and will remove the discouraging and erroneous idea that medicine will never become a positive science. Up till now the method of clinical research has not been truly positive, because it has not been in complete harmony with the naturalistic method.

IV. Morphological Examination of the Heart.

1. *Insufficiency of the Plexic Examination and of the Averages.*

I say "morphological examination of the heart," for the ensemble of the researches which must be instituted have a scope superior to that which is reached ordinarily by the simple plexic examination. As we shall see presently, the amount of vertical dulness and of transverse dulness, though defined with care and exactness, are not sufficient to complete the system of research which we propose to ourselves with the morphological examination.

Generally, when one is percussing the heart, one does not think particularly what the heart is in the concrete case as regards its development and form. Nevertheless, the heart in every individual is what it must be according to its primitive development, according to the development reached in the successive stages of life, according to the necessary functional relations which the viscus has with the other parts of the circulatory system and with other viscera, and, in fine, according to the different hygienic circumstances.

This applies to its normal, and especially to its pathological, state.

That the heart may be, even in healthy men, of different proportions has been mentioned by Laennec: ". . . . *Notwithstanding this,*" he writes, "*the disproportion of this organ with the others, and that of its various parts one with another, are compatible with the healthy state.*"[1] In several places in his very valuable work, speaking of the heart, he mentions the fact through which it may present itself more or less proportionate, and gives indications for recognizing it clinically. Moreover, he went so far as to suggest a formula, which clearly shows us how important he considered the acquisition of exact knowledge regarding the development of the heart in every individual. It is as follows: "*The heart, with the auricles, ought to be about the size of the fist respectively to every individual.*"[1]

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[1] Laennec, *Trattato dell' ascoltazione mediata.* Translation of the fourth edition, vol. ii., p. 152.

And that Laennec methodically instituted such researches on the heart is proved by the clinical and anatomical findings, which he discusses not only in relation to heart diseases, but also to others, as I have shown with apposite quotations in another work of mine, which I shall have occasion to refer to more extensively later on.[2]

Besides, it cannot be denied that the scope which those desired who successively proposed either new methods or modifications of existing ones for the plexic examination of the heart was always a topographical scope.

Here I need not pass in review the methods of percussion of the heart. Besides, I can maintain that no writer, including Avembrugger, Piorry, Skoda, Stokes, Bamberger, Friedreich, Gerhardt, Baccelli, Dusch, Bucquoy, P. Niemeyr, Botkin, Da Costa, and Paul, has suggested my method.

This method, which was perceived intuitively, as I have said, by Laennec, and was demanded by the theories of modern morphology applied to clinical medicine, is the fruit of very long study. I gave a sketch of it in my *Theoretical and Practical Course on Percussion and Auscultation*, and I published it in its fundamental lines in 1871 in the *Sperimentale* of Florence and in the *Gazzetta medica italiana lombarda*. Since then I have improved it, and after twenty-five years of proof I flatter myself that it can be taken into some consideration.[1]

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[1] *Loc. cit.*, p. 172. I have been astonished to find in Paul's work (*Diagnostic et traitem. des maladies du cœur*) the following sentence: "*Laennec n'avait pas d'autre moyen de mesurer l'hypertrophie du cœur que l'absence ou la diminution du son donné par la percussion sur la région du cœur, mais il se contentait d'un à peu près.*" That the results obtainable by the physical examination then practised did not reach exactness was not necessary to reveal citing Laennec. On the contrary, it was necessary to reveal that this very wise observer made use of all the means of which he could dispose for approaching that exactness and that morphological conception which indicate precisely a progress in our days. Saying that Laennec *se contentait d'un à peu près* signifies leading one erroneously to believe that he, in this connection at least, was much less of an observer than what he was.

[2] "*Sulle alterazioni del cuore nella tisichezza polmonare*" (*Bullettino scientifico.* Pavia, 1887).

It will not be out of place to reproduce here what I have written in an article entitled "The Heart in Pneumonia" (*Gazzet. med. delle prov. ven.*, 1883).

The heart is a motor which is constructed according to definite laws.

Its mass, form, and position are three elements that mutually influence one another. The muscular mass must be proportionate to the amount of mechanical work which the heart has to perform. Its form and position in the thorax are the result of the resistances that the cardiac cavities have to overcome during every moment of their function, besides the direction in which the cardiac energies develop. If, however, by chance the resistances increase or diminish, the size of the organ will vary in proportion, and the variant will manifest itself in that part of the heart where the resistance increases or diminishes.

The heart has originally an utricular form, and occupies the median line almost in the vertical position. But with the development of the vascular apparatus it gradually becomes modified in the way that all know.[2]

That which determines the development of the heart within the body is therefore a law of adaptation ; that which concretes itself in the heart is a function of anatomical and physiological correlation. One can say, therefore, that the heart must be what the circumstances of primitive formation and the functional circumstances require it to be as regards mass, volume, and position.

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[1] A certain writer, dedicating himself to the study of the percussion of the heart, has believed that he could put my method of examination of the heart, called expressly *morphological*, beside another, which must be called *topographical*, for the purpose of making comparisons and considerations which are non-existent. For the *topographical* limitation of the heart, I myself have proved that every method may serve, with some slight variant ; for, knowing the morphological state of the heart, the morphological method is necessary. I do not presume to have arrived at perfection, but I believe that I have interpreted the requirements of the modern naturalistic doctrines.

[2] The heart of the chick in its first phases of development has the form of an utricle, or, better, of a tube which receives at its inferior part the blood brought by the two vitelline veins, and pumps it into the two primitive aortæ situated at the superior end. With the successive increase of the blood-mass the tube, bending upon itself, distends. When the double tube of Cuvier appears, and especially when the inferior vena cava conveys new blood, the shape of the heart becomes much more modified, and the cavity of the auricle, the ventricle, and the bulbus arteriosus become clearly designed (Preyer, *Phisiolog. special. d. l'Embryon*).

One sees in this the law of adaptation effectuating itself: the increased quantity of the blood or the greater amount of the functional stimulus within the space conceded to the heart changes its capacity, form, and function, since the heart, which first began to beat in its venous portion, later presents contractions which recur regularly in the arterial portion.

These thoughts are sufficient to enable us to comprehend the fact by virtue of which the heart, besides showing differences inherent to age, sex, etc., presents other individual differences. Further, in every person we find special conditions inherent to the complexive development of the body and to the development of some parts which are in strict relationship with those of the heart.

And, above all, we wish to record what appertains to the innervation of the individual, which declares itself so differently, as is known to all, in the functions of the cardiac plexus, or in the greater or less affluence in this of reflex phenomena.

Finally, I shall add a few remarks on the so-called synergic phenomena, by virtue of which the movement of one part is the instigator of movement in another. Hence, owing to these latter circumstances not being identical, but necessarily different in different individuals, the heart must be withdrawn from the calculation of the averages—must be as to mass, volume, and position that which the whole of the internal and external conditions of the individual require it to be.

Here comes in practice to support the theory. The researches of Senac, Bouilland, Bizot, Peacock, Baccelli, Gerardt, Beneke, Thoma, and others, are much more valuable for showing the individual variant which the heart presents as to weight, size, etc., than for constituting those averages which are indefatigably sought for—averages which in every concrete case reveal their absurdity or at least their insufficiency.

Bizot says, for example, that the heart increases its dimensions throughout life in an absolute and relative way, on account of the wasting of the body in old age ; that the dimensions of the female heart are less than those of the male ; that tall people have, as a rule, a relatively small heart ; that those who have broad shoulders have a big heart ; that the ventricular cavities augment with years ; that normally the cavity of the right ventricle is greater than that of the left ; that the walls of the right in the course of years increase in thickness more than those of the left. But all these, and other very important notions, are useless to the clinician, excepting in the sense that they enable him to comprehend the large number of physiological factors which influence incessantly the central organ of the circulation ; while for the clinician it is important to know positively whether all or many of these influences have acted, and in what proportion. It is important for him to possess precise criteria for determining what the heart is at the moment in which a judgment is necessary, and which is rendered much more important and difficult, when one cannot compare the present state of the heart with that of a former time.

Beneke says that at the second year of life the heart has doubled its size ; that at the fifth year it has again doubled it ; that it grows more slowly up to the fifteenth year ; that from the fifteenth to the twentieth year another rapid increase occurs ; that it grows slowly once more up to sixty years ; and that beyond this age it may diminish.

But the clinician can make use of these and similar notions solely for the purpose of completing a theoretical physiological conception. When examining the heart for diagnostic scope he must, on the contrary, neglect these notions, because, first of all, they are not incontrovertible laws, and then because they are derived from a series of observations which, even if together, they may constitute a law, separately taken represent so many individualities physiologically distinct from one another.

Robinson has found that the weight of the heart in respect to that of the body is greater in short than in tall men. This statement agrees with that of Bizot, already cited, that a long body has a smaller heart than a short one, and with that of Beneke, that in tall and thin persons, together with arteries incompletely developed, one finds a rather small heart. But in the concrete case, what must be the size of the heart ? The usual reply is : Proportionate to the organism. Well, where are the tables which show us that size of the heart with its proportionate skeletal height, those proportionate muscular masses, that corresponding ensemble of organs, that given nervous functional capacity, those consequent habits, etc. ? Such tables are not to be had, nor will they ever be had, no matter how the observations may be increased. We may form groups of individualities similar, but not identical—groups of individualities in which it will be shown that the heart more or less developed takes a certain part in the maintenance of the circulatory conditions or in contributing to definite morbid states ; but the *quantum* of this special cardiac function, or otherwise—the precise morphological value of the heart—will always remain to be defined.

I believe that the conception of Laennec already referred to is just, and deserves to be taken into serious consideration, for in its simplicity it shows the fruit of long observations, and is in agreement with the principles of morphology, as well as those of physiological correlation, and with the above-mentioned facts.

The conception of Laennec, as we shall see, will help us to approach at least to the determinism which is longed for in clinical practice. I am certain that if it be taken in its scientific, but not literal, expression, one will find in it, by means of long years of able researches, the way for discovering the relations perceived intuitively by it.

Someone, apropos of what Laennec thought on the size of the heart, may say that the size of the hand can vary *ad infinitum* owing to the influence of causes which cannot in any way act on the heart. But this criticism discloses the weak side of the critic as regards modern naturalistic knowledge, ignoring the relation of development which exists between certain parts of the body and certain others ; and it also shows that he who wishes to make it ignores all the thousands of facts collected by the above-mentioned authors, all allusive to the law of anatomical correlation—facts collected without prejudice, and therefore all the more important for their scientific signification.

Having made my share of observations, I am in the position to declare that such criticism is altogether theoretical and in contradiction with the results of experience.

2. *Method for the Morphological Examination of the Heart.*

This method consists of three parts : the first concerns the research of the cardiac diameters ; the second the determination of the relations or proportions between the heart and the organism ; the third the verification of the functional relations.

1. *Research of the Cardiac Diameters.*—Clinical and anatomical observations have enabled me to proceed in the following way : First of all, I locate the position of the two points *a* and *b* (see Fig. 6, schematic), which, united by a line, mark the level and

extension of the base of the heart. In the majority of cases one can with the finger find the spot corresponding to the heart's apex, *c*, in the fifth intercostal space; having found this, I unite it with *b* and with *a* by means of two lines. Thus results a triangle, each of whose sides measures the real length of the sides of the heart, of which *a b* represents the base, *b c* the longitudinal axis of the left ventricle, *a c* the longitudinal axis of the right half of the heart.

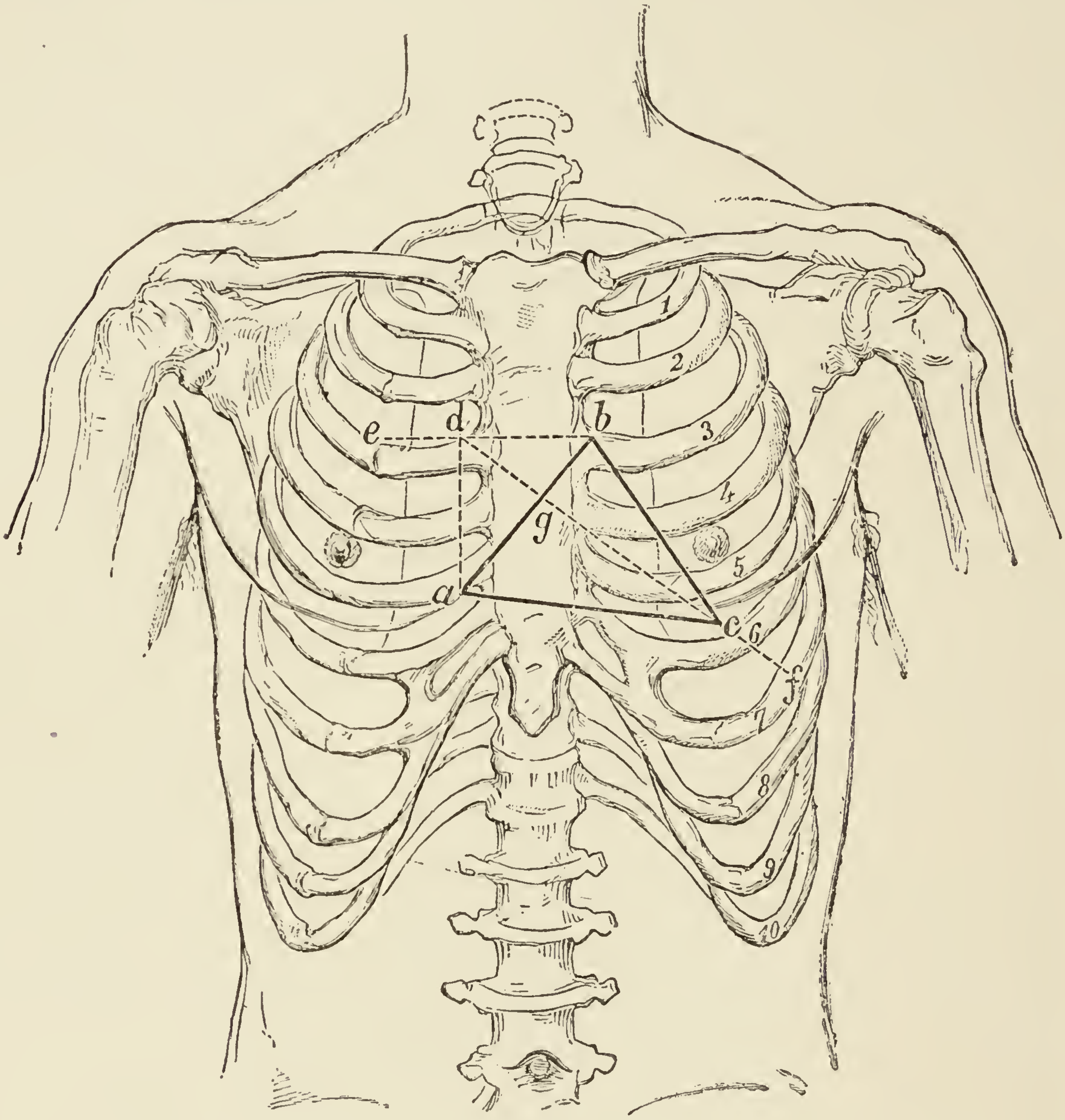

Fig. 6

But the apex of the heart is not always visible and palpable to enable us so readily to reach our scope, and then I proceed as follows: From the point *a* I raise the line *a d* parallel to the axis of the body; from the point *b* I draw on *a d* the horizontal line *b e*, so that at their point of meeting they form a right-angle.

From the right-angle *d* I draw the secant *d f*, and on this I make percussion from below upwards. Below is the gastric resonance, which gradually diminishes. Where it ceases one perceives a slight increase of resistance to percussion; this is the seat of the cardiac apex.

If one attentively observe the figure, one sees that the secant *d f* divides the right-angle into two unequal parts, a superior third and two inferior thirds. Thus one also sees that the base of the heart *a b* is divided into similar proportions to those of the right-angle.

This constitutes a circumstance of no slight interest, which must be well considered, because it refers to facts appertaining to the organ which we are examining, and offers not a few modifications.

Meanwhile I would remark that, for the greater simplicity of the method, one can omit drawing the lines *a d*, *b e*, forming the right-angle, and can straightway divide the line of the base *a b* into two parts, *a g* and *g b*—that is, in the point where two-thirds of the line unite with the other third. But when one has acquired sufficient practice—which, besides, is quickly obtained—it will not be necessary to mark on the skin of the patient all these lines and divisions, for everything can be done ideally by the eye; it is sufficient to mark precisely the points corresponding to the ends of the base and to the cardiac apex.

It may happen that the apex is not found exactly in the direction of the line *d f*. In that case this line must divide the right-angle and the base *a b* equally; then, repeating the percussion as I have described, the apex will be found.

If some should think that these variants of the method inspire little confidence, I would observe that I have been able to convince myself of the contrary; that, having to do with an organ capable of modifying itself as a whole for many reasons, which everyone without doubt will admit, it is necessary that the method of examination be adapted to possible modifications.

These refer to the position, functional energy, degree of variation of internal pressure, etc., by virtue of which the form of the heart may vary in different individuals through physiological and pathological reasons. No wonder, then, that the geometrical relations of the lines which represent the real length of the sides of the cardiac triangle have likewise to undergo variations.

I may add that many years' experience has convinced me of the truth of these facts, which have been controlled daily by my assistants and students, and not even the control of the post-mortem has been wanting.

I now return to the research of the cardiac apex. Cases are not wanting in which, by means of percussion on those points indicated for finding the apex, one fails to make out precisely the spot where the modification of the plexic sound which corresponds to it is. Similar cases are met with when, owing to emphysema, the pulmonary resonance is exaggerated, or when the gastric resonance is so diffuse that it generates uncertain results, or when, owing to other causes, abdominal meteorism exists. In those conditions I advise a line to be drawn on the thorax corresponding to the diaphragmatic hollow, which can be done by attending to the anatomical facts concerning the point of attachment of the diaphragm. This line intersects that which ideally or really descends from the base of the heart, according to what I have indicated above in the cases of simple exaggeraton of the gastric sound. Over the point of intersection is found the cardiac apex, which can be confirmed by auscultation. When, through the displacement of the heart by abdominal meteorism, we see its topographical relations modified, we do not act differently from that which serves for the normal cases ; having found the base of the heart, the rest is determined by the direction of the level on which it resides.

2. *Determination of the Proportions between the Heart and the Organism.*—I have already said more than once that I have no faith in the averages, and I have given my reasons. Hence I have considered it useless to give the figures which concern the length of the sides of the cardiac triangle.

I think it necessary, on the contrary, to indicate the relations which exist between the sides of the triangle for establishing the rules for proceeding to the determination of the proportions which here one is in search of.

In individuals perfectly healthy and having a morphological type which I would call normal, we have the following relations between the sides of the cardiac triangle : If, for instance, the base measures 9 centimetres, the left ventricle will measure 10, and the right ventricle 11 centimetres. I believe I can maintain that in normal conditions the difference between the base of the heart and the left ventricle may be even half a centimetre instead of a centimetre. Nevertheless, it is certain that the difference of a centimetre represents a morphological state of the heart better than that of half a centimetre.

The variants which may occur in the cardiac triangle are recognized by the disappearance of the indicated relations. For example, base = 10, left ventricle = 11·3, right ventricle = 13. Here the maximal disproportion concerns the right ventricle. The part which this contributes to forming the base and the apex naturally increases somewhat the proportion of the base and of the left ventricle; but at any rate in the maximal disproportion which refers to the right ventricle rests the criterion for concluding that the cause of the complexive enlargement of the heart is due to the right ventricle by reason of the entity of the disproportion of the side of the triangle which appertains to it.

In the successive observations on the individual we will obtain further data for the greater confirmation of the fact, verifying the variations of the limits which appertain to the heart and the physiological coincidences with which the variations recur.

If in another case we find the base = 10, the left ventricle = 12, and the right ventricle = 12½ or 13, we must conclude that the main cause in the increase of the cardiac area is due to the left ventricle, for the maximal disproportion devolves on it; although, owing to the part which it takes in forming the base and apex, the base and the right ventricle must appear augmented in proportion. According, then, as with that given disproportion of the left ventricle one finds also greater disproportion of the right, one can infer from it whether the increase of this must be attributed to that of the left ventricle or to causes which have taken place in the right, as occurs when, through hydraulic reasons very easy to occur, it dilates.

Our conclusions will be strengthened by other facts. In the first example—namely, that of increase of the right ventricle—one will also see the apex of the heart displaced more or less externally; further, the dulness which indicates the extreme right of the base will be somewhat removed from the median line. In the second example—namely, that of increase of the left ventricle—the apex will be somewhat lowered, and the point of dulness which indicates the extreme left of the base will also be somewhat removed from the median line.

These two examples will be sufficient for enabling one to comprehend the method of interpretation of the cardiac triangle. But it is advisable to mention that the heart is a viscus subject to many variations depending upon physiological causes—variations which it is important to recognize, especially during disease, because the state of the heart also has physiological elements capable of contributing to the explanation of certain morbid phenomena, as I shall show more diffusely later on.

Now, we wish to establish whether the heart is adequately proportionate to the body or not.

For this scope I have adopted a method which was suggested to me, as I have said, by the experience of Laennec, but which I have rendered practical by my own experience.

Laennec's conception, which I have already described, concerning the size of the fist put in relationship with that of the heart appearing to me to be more and more regardable, I have undertaken a series of observations for establishing what is that part of the fist—in normal conditions—which corresponds with a definite part of the heart. The results are as follows :

If one measures the thickness of the right fist (*in left-hand persons of the left*), *placing the tape-measure on the extremities of the first phalanges of the index and little fingers, which articulate with the respective bones of the metacarpus, and fix the ends of the measure surrounding the joints in such a way that it includes their thickness, one will have the measure of the base of the heart* (see Fig. 7).

This is a fact, not an opinion—a fact which has been subjected to the proof of experience in the following way : I myself have measured the base of the heart, others the fist, and the figure announced by me agreed (in normal conditions) with that read by others on the fist. I have also measured the fist, others the base of the heart ; then I gave correctly the figure appertaining to the latter, inferring it from the measure of the fist. My conviction on the truth of these data and on the utility of their application is full. Every day I employ this method for solving questions that clinical pathology presents regarding the heart.

From the foregoing it results that, having known the length of the base by means of the measurement of the fist, one can know in the concrete case what the length of the side of the triangle which corresponds to the left ventricle and that of the side which corresponds to the right must be. If, for instance, one refers 9 centimetres to the base, one will attribute 10 to the left ventricle and 11 to the right.

To prove all this on the anatomical table, we select a cadaver free from all symptoms of pulmonary and cardiac diseases, and from alterations of the belly, which would have aggravated the circulatory conditions. The fist is measured, and then the tape is placed in the direction of the base of the heart between the points of the chest, which, as we have seen, coincide with the ends of the base of the heart. Long needles are pushed into these points to the extent that they remain perpendicular to the axis of the body. Then the cardiac triangle is constructed, attributing the proper value in centimetres to each side of the heart. Where the two sides meet, a third needle is inserted as above. All this is done without having recourse to the aid of percussion. Then the thorax is opened, taking care not to displace the needles, and we find that these have fallen in perfect coincidence with the ends of the sides of the cardiac triangle, or that one or other of the needles of the base have either pierced or simply pricked the heart ; consequently the one or the other will have passed distant from the relative end of the base, and thus the needle of the apex will be distant from this in proportion.

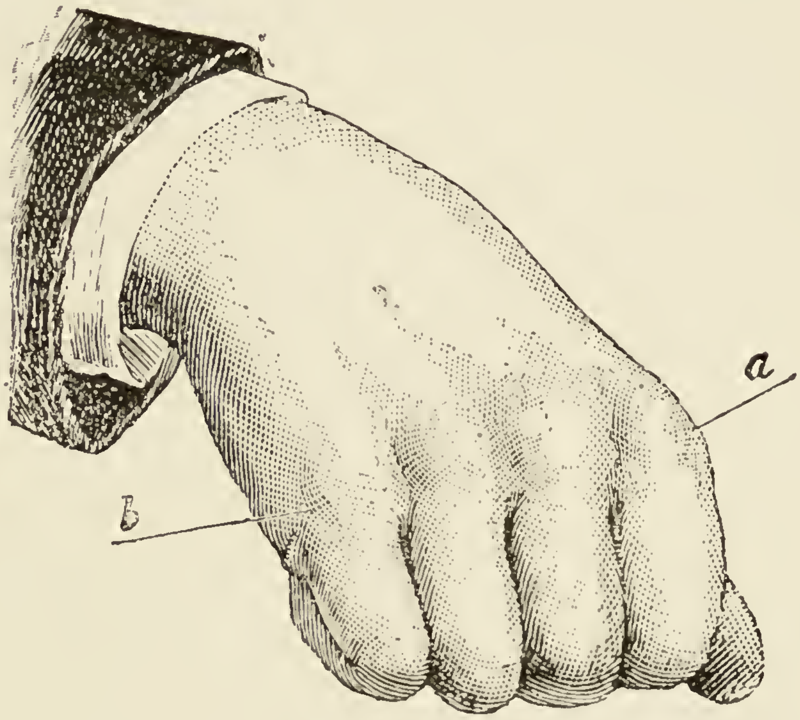

Fig. 7.

a, *b*, The points on which the ends of the tape-measure must fall.

If, however, we tie all the vessels which enter and leave the heart, and then remove it, leaving the needles *in situ ;* or if, having first carefully measured the distance and arranged the heart in such a way that it will have almost reacquired its position in respect to the observer, they are suitably placed at the respective ends of the cardiac triangle, we will verify that its dimensions are within the pre-established confines.

If there be differences in millimetres—or, to speak better, in a millimetre or two—I believe that they ought not to generate diffidence or plausible motives for not accepting the result in its most important part.

I have said that all this is done in normal conditions and without having recourse to the aid of percussion, because one sees the value of the method, and understands with little or no difficulty the importance of a law which results from my observations, and which I express as follows : The heart in the thorax has certain relations with the chest wall, which are determined (1) by the intrathoracic pressure ; (2) by the hæmodynamic conditions ; and (3) by the intra-abdominal pressure.

All these mechanical researches in normal conditions act in a harmonious way, because the heart in the mediastinum behind the corresponding parts of the thorax always coincides with the same parts.

These relations are also maintained in some deformities of the chest ; but the knowledge of these relations, as we shall see in another place, directs us to the examination of the heart, even when it appears that the deformity is the determining cause of modifications of the above-mentioned topographical relations.

But on the living man one always makes percussion, and this will aid one, because the heart is an organ which is subjected to very many physiological influences that may induce in it some change which must be verified. Moreover, I have no intention of denying the importance of percussion as a means for investigating the heart, as is seen from what I have said above ; while I would add here that it is valuable as a means of control for this or that particular referable to the cardiac mass, the vascular volumes, and so forth.

And it is for being able rigorously to estimate the physiological and pathological changes of the heart that a morphological index is necessary, without which one has no rational means for determining the proportions between the heart and the body, which are not only useful, but necessary for our morphological examination.

Having explained the cardiac triangle in the concrete case, I shall now compare the length of the base with the thickness of the fist, and the difference which I find will indicate a change that has happened in the heart.

I do not wish to speak at present of the changes of the heart, because I must confine myself to showing the application of the method.

According to the differences which are verified between the thickness of the fist and the length of the cardiac base, we shall draw different consequences. I shall now give examples obtained from clinical experience.

First Example.—The fist measures 9 centimetres. I must admit a heart with the following proportions: base, 9; left ventricle, 10; right ventricle, 11. I find, instead: base, 9·5; left ventricle, 12·5; right ventricle, 11·8 (sometimes even 12·5). I conclude that the enlargement of the heart is devolved on the left ventricle, because, having put in relationship the measure of this with that of the base and of the right, we see that it is that which has undergone the greatest development.

This is a fact which may present itself in different proportions in different individuals; consequently it expresses in some cases a truly pathological condition, in others a morphological adaptation of the heart, which, however, indicates a state near to being pathological.

Whatever the case may be, it is well to be able to say whether the left heart has reached proportions corresponding to the requirements of the individual; whether these proportions are within the limits of physiological adaptation, or are near it, or have already exceeded it, and to what extent.

Second Example.—The fist measures 8 centimetres. The heart at the base, 9; the left ventricle, 9; the right ventricle, 11. According to the morphological index, we will have: base, 8; left ventricle, 9; right ventricle, 10. Conclusion: The heart is complexively larger than it should be, but the enlargement is due especially to the development of the right ventricle.

This is not a case which, like the preceding, can be referred in the proportions given to a true cardiac defect, even if by chance the individual should complain of some disturbance of the heart. It is, on the other hand, met with rather frequently, as we shall see later on, when by virtue of special hydraulic reasons inherent to the morphological condition of the patient the right ventricle is abnormally developed.

This case, in different proportions, is observed when, even independently of the hydraulic reasons just mentioned, others arise, more or less temporary, capable of perturbing the circulatory function, necessitating turgidness of the right ventricle.

When, in their place, we describe the different *morphological combinations*, together with the relative morbid pictures, we shall enter into other particulars which will show more clearly the importance of these.

Third Example.—The fist is 9·5 centimetres. The heart at the base, 12 ; left ventricle, 12·5 ; right ventricle, 13. Normally one ought to have : base, 9·5 ; left ventricle, 10·5 ; right ventricle, 11·5. Conclusion : Size of the heart extraordinary. In respect to the base, both the left and right ventricles are enlarged, but the latter not in the proportion that it usually is when to it alone is due the cardiac enlargement. In this case the dilatation of the heart has followed its hypertrophy. Our judgment will become more precise, by establishing in what direction the cardiac apex is displaced, and seeing if the right or left end of the base is the more displaced from the median line ; both, however, are removed from the normal seat.

Fourth Example.—Cardiac index—thus I call the measure of the fist—measures 10 centimetres. The heart at the base, 15 ; left ventricle, 12 ; right ventricle, 13. Here the heart is not only enlarged, but strangely deformed. It shows an extraordinary dilatation, through which the relations between the base and the ventricles are so altered that one must admit the dilatation is not to be attributed, as it was in the previous case, mainly to the right ventricle. The base exceeds by a long way the length of the ventricles. Well, when the base extends, owing to the development of the right ventricle, the border of the latter extends in proportion. Thus it generally happens when the base increases by virtue of the enlargement of the whole left ventricle. How is it, then, that in this example the base is enlarged in such a manner that it is not in proportion with the two ventricles ? I answer with the necroscopic finding : One observes that the heart is enlarged as a whole, but the left ventricle, and precisely in its upper third, presents an enormous dilatation—a kind of recess which has been effected in the interventricular septum, that at the spot indicated is seen projecting into the cavity of the right ventricle. The cardiac index is 10 centimetres. The alteration of the heart by hypertrophy and successive dilatation would necessarily have increased the length of the base and that of the sides of the ventricles, but the way in which the dilatation occurred, especially at a given point, has rendered possible the alteration met with in the proportions of the heart.

As I have said several times, the heart is an organ which, in the functional activity that belongs to it, finds the reason of continuous changes. Some are observed during the different phases of life, and are those which are attributed to growth ; others are changes which intervene by virtue of the mutual influences that the different apparatus exercise on one another.

Therefore we must endeavour to discover these circumstances with the object of being able to value other conditions of the organism, which depend partly on the mode in which the heart functions, its function being connected with its morphological condition.

Making, then, exact application of the method, one will meet with different cases : in some the heart is found in perfect coincidence with the cardiac index ; in others the left ventricle is larger than it ought to be ; in others the right ventricle. This ventricle especially may offer daily modifications connected with the respiratory and digestive functions, muscular fatigue, and nervous exhaustion.

The value, therefore, of the method is shown—first, by the possibility of instituting morphological relations between the heart and the organism ; secondly, by the possibility of estimating with precision the facts inherent to growth and those depending upon other causes ; thirdly, by the facility with which one can discuss by means of the morphological data of the heart eventual morphological states relative to the vascular system, the heart being, as it is, connected in its turn with the function of anatomical and physiological correlation.

The heart from the beginning to the end of life of the individual *exercises a function which undergoes variations, and it must adjust itself to the requirements of these. It pumps rhythmically a blood-mass into the vascular tree, and receives from this another blood-mass, both together considered greater or less, and modified by all the functions of secretion and absorption, with motion determined by many mechanical causes constantly notable ; but it, continually adapting itself, maintains the equilibrium,* within certain limits, *in the irrigation of the organs.*

The function of the heart responds more or less precisely to the hydraulic requirements according to whether its organization, considered in the muscular fibre, the capacity of its cavities, the innervation which imparts to it nutritive and functional irritability, and the functional resistance, is excellent or not.

Every error of anatomico-physiological correlation determined during life is the cause of biological variations which depend upon it, consequently of special eventual morbidities.

Many physiological and pathological conditions, by which are almost characterized certain phases of growth and of the successive evolutions of the organism, manifest themselves, modify themselves, and dissipate themselves in connection with the hydraulic phenomena, thus intimately subordinated to the play of the anatomical and functional correlations above mentioned. In this also physiology receives from the clinic a precious tribute of knowledge, because the clinic alone can observe, co-ordinate, and interpret the phenomena which concern the general laws of *hæmodynamics.*

3. *Verification of the Functional Relations of the Heart.*—If it were given to us to verify in man all the physiological factors which concur in promoting and maintaining the functions of the heart, we could avoid many causes of error in our estimations. Very frequently one thinks of the influence of the nerves, rarely that of the blood, although one knows that this also has its part, and that its stimulating qualities, so to speak, on the cardiac function may vary. One thinks likewise of the muscles of the heart. But when in the particular case it is necessary to settle which of the above-mentioned physiological factors must be the more active, one cannot make so many analyses, and satisfies the exigency having recourse to the influence of the nerves.

This is never wanting ; but invoking it alone, in my opinion, only avoids the question.

If we feel the radial pulse with one hand and the cardiac pulsation with the other, we will find an exact correspondence between the impulse of the heart and the pulse of the artery. In another case, on the contrary, we will not find this correspondence ; the impulse is relatively strong, but the pulse is small and weak. In the former case one can say that all the cardiac work displays itself in the pulse ; in the latter no, because it would appear that only a part of it is utilized.

If one did not institute this relation between the impulse of the heart and the pulse, one would have neglected a valuable physiological notion useful to the clinic.

In fact, what is the reason of the difference noted between the two cases ? What effects will be derived from this difference ?

The reason is deduced from the facts and from considerations on the facts. The strong impulse, with the small pulse, we find in individuals who have a deficient development of the arteries ; the small and weak pulse in those in whom (besides the deficient development of the arteries) the heart, in spite of its forced activity, fails to produce a greater degree of tension in the arterial system.

We make our investigations on the heart, and we find that the left ventricle is a little inferior to what it should be, while the right ventricle is somewhat increased. We repeat the investigations in different conditions (of rest, activity, fasting, etc.), and we find variants in the pulse and also in the heart ; but the quality of the pulse special to the individual always remains.

If, on the other hand, the small radial pulse be strong and resistant, the heart produces an hydraulic effect equal to the force of action which it expends at every systole ; hence the left ventricle will indicate somewhat of an increase, and the right ventricle will remain more or less normal.

All this means that the left ventricle, in the different cases in which the pulse is small through narrowness of the arteries, must overcome the resistance, and do so with different capacities, and therefore with different intensity of effects. It means that the heart is forced to a physiological effort, from which different consequences are derived. Either the effort is followed by proportionate nutrition, and therefore development, of the myocardium, and then the cardiac activity and the hydraulic effect increase also in proportion, and thus render necessary the development of the arteries ; or the cardiac effort is not assisted by the necessary trophic facts, and then is continued a state of things which, in respect to the arterial system, is called "vascular hypoplasia," and in respect to the organism reveals itself differently in the form of individuals in whom the process of general nutrition seems to be deficient.

These are the consequences which may be determined in those who present the above-mentioned differences between the cardiac impulse and the arterial pulse.

But if we continue our observation, we will see later on other consequences determined in the heart itself. In those in whom we see the heart struggle in vain against the circulatory obstacles depending upon arterial hypoplasia, one sees a gradual increase in size of the heart which assists in proportion the growth of the organism ; but its activity is not increased in proportion to the development. In these cases one verifies a discord between the plexic result and the cardiac activity, this not corresponding to the extent of the visceral dulness.

In the cases in which we find the increased activity of the heart followed by corresponding nutrition of the myocardium we can verify, finally, a true hypertrophy of the left heart. Neither palpitations, nor thrills, nor other phenomena show the existence of any pathological condition whatsoever of the heart. The individual has a heart so developed—to which corresponds exactly the cardiac index, as I have verified also in one of my assistants—that it guarantees in an imperturbable way the hæmodynamics and the functions which depend on it. Here, therefore, we have a hypertrophy of the heart indicated by the cardiac index which may be called "physiological."

Yet there are cases in which hypertrophy of the left ventricle, which takes place during growth, may become a true pathological condition. Then its function is truly abnormal ; there are symptoms of hyperkinesis, more or less, and the cardiac index is exceeded by the line of the base, which in proportion is less than that of the left ventricle. We have, therefore, a hypertrophy of the heart indicated by the cardiac index which cannot be said to be physiological.

Hence, one must admit a state of things relative to the heart and vessels by reason of which it is necessary for the heart to make an effort to succeed in its task—an effort which may be followed by different results, according to how its nutrition and the development of the vessels proceed. One can call it a *physiological effort of the heart*, inasmuch as it endeavours to reach that condition in the hæmodynamics which is suitable to the physiological state of the individual, but which may present itself also as the indication of special morbidity, according to the cases as we shall have occasion to show clinically later on.[1]

Here we note that the physiological cardiac effort may be limited to the left or to the right ventricle ; consequently, when we desire to verify the functional relations of the heart, it will be necessary to examine it as a whole and possibly in its parts.

It is known that the functions of the two ventricles may vary in their force or duration in certain definite pathological conditions, but what I intend in my case is to refer to physiological conditions. Nevertheless, I must mention that the importance of the observation contributes somewhat to the interpretation of pathological facts. In reality, if we study two hearts appertaining to patients suffering from the same heart affection, we will find differences which do not depend upon the kind of affection ; they are accidental. But when we see them modifying the form of the heart, and remember that its form depends upon the quality and quantity of its function, it is necessary to conclude that, while the whole heart is under the influence of the affection, some parts of it are subjected to this influence more than others. This may be said to be connected with the quality of the affection, but one must admit that it is also connected with the nutrition of the parts. Hence each part is shaped according to whether it is more apt to dilatation or to hypertrophy ; therefore the heart, as a whole, conforms itself to the requirements of the affection, first with the original functional energy, then with the energy gradually adjusting itself to the growing requirements of the affection, in such a way that the hypernutrition of the parts specially responsible for the complex mechanical work of the organ corresponds to the continually increasing functional requirements. When this functional correlation ceases, we have weakness and dilatation of the heart.

If we desire to inform ourselves of the action of the heart following the physiological criteria, to complete our conception of its morphological conditions, we must have recourse to the cardiographic examination, because sometimes inspection, palpation, and the comparison of the motor phenomena of the heart with those of the vessels are not sufficient for an exact examination. In the cardiogram we have data which are sometimes very valuable. But here I cannot dwell further on this subject.[1]

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[1] I have already dealt with this question in the *Giornale internazionale di scienze mediche* of Naples, N. 1, 1888.

From the foregoing it results that, studying the functional relations of the heart, we can establish—first, whether its function corresponds to its volume or not ; secondly, whether the physiological cardiac effort takes place ; thirdly, whether, owing to the cardiac effort, hypertrophy or dilatation occurs, and of which part ; fourthly, to which vascular contingencies these results of the efforts are due ; fifthly, the morbid dispositions depending upon them.

V. Examination of the Abdomen.

According to what I have stated in the section which deals with *measurement*, it appears that when one has to make the examination of the abdomen, it is necessary to acquire exact ideas regarding the development of the organs contained in it.

From the ordinary fact through which one can assert that the belly, even considered in its normal state, presents variations of development and form, and from what precedes, it is easy to conjecture that to the different development and form of the belly correspond differences in the development of the abdominal organs.

Hence arises the necessity of obtaining definite criteria on which to found our opinion ; and these criteria must be derived, above all, from the measurement of the part, and from the interpretation of the results which are obtained from it.

The procedure which I adopted in studying this arduous question was that of clinical observation—the same which I subsequently adopted for introducing my students to this order of ideas, with the difference that, for learning what I can now teach in a short hour, I had to study many years, *observing, meditating quietly*, registering physiological phenomena, morbid conditions, symptomatic coincidences, anatomical findings, concluding with the utmost circumspection.

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[1] The cardiogram shows us the state of pressure in the large arteries, and the degree or the intensity of function of the different parts of the heart. Moreover, it shows us the time in which certain phenomena take place, such as the catacrotisms, etc. For all that, I do not wish to abandon that which is the result of my experience, and which I have published in a memoir entitled, *Prime linee d'uno studio cardiografico volto a scopi clinici* (Milan, Tip. Rechiedei, 1878).

While passing along this long road, I became aware that, although anatomy is said to be the basis of medicine, physicians do not bestow a thought on many important anatomical circumstances. Some of them even worry their minds inventing theories for explaining facts which sometimes seem extraordinary, and which have, on the contrary, their reason of being in a definite anatomical condition, either morphologically normal or abnormal, which has been overlooked.

This is so true, that when confronted with several patients suffering from the same disease—let us say hepatic cirrhosis, abdominal scrofulosis, or chronic intestinal catarrh—they discuss the symptoms, treatment, etc., always following the same order of ideas which are accustomed to explain the pathogenesis and the curative effects, without calculating that some of the patients have bellies differently formed to those of the others; that the different capacity, and the primitive development differing in its principal parts, indicate special morphological combinations—that is to say, different functional combinations, which are equivalent to different morbid dispositions.

We shall have to divide the infinite varieties of combinations into groups, because our experience has not yet succeeded in revealing with exactness the different individualities that exist in the darkness of the belly. Meanwhile the comparative study of this has led to other conquests which are necessary to clinical determinism.

The little that I have gathered from my researches refers not only to the abdomen as a whole, but also to the liver, intestines, large abdominal vessels, and kidneys.

With regard to the abdomen, instead of repeating here what I have said about the measurement, I shall refer to the importance of the xipho-umbilical and umbilico-pubic lines. If, when taken together, they give a precise idea of the vertical diameter of the cavity occupied by the viscera that constitute the digestive apparatus, considered separately they indicate the two sections of the belly into which this is divided by a transverse line passing through the umbilicus.

It is known to all that the obstetrician judges the maturity of the new-born infant from the position of the umbilicus in respect to the longitudinal axis of the body. It is also known to all that, like the whole body, the abdomen becomes modified in its form with the growth in years. Now we wish to ask ourselves if it be indifferent that the abdomen has in the adult the same form which it presents in the child or in the new-born infant ; if it be unimportant that the umbilicus is situated in the centre of the xipho-pubic line or lower, as more frequently occurs, or higher, as rarely happens.

It is precisely to the obstetricians and to the specialists in pediatrics, to whom it must be of the highest interest to recognize the characters of maturity and immaturity of the new-born infant and the child, that I recommend my method of measurement. From their finding will arise very important data, by means of which they can reason better on physiology, morbid dispositions, hygiene, therapy, and so on.

If we examine the belly of many individuals in whom there are none of those morbid conditions that are apt to modify its form, we shall find as follows :

1. The belly, as a whole, may be proportionate to the rest of the body.
2. The belly may be large.
3. It may be small in proportion to the rest of the body.
4. Individuals who have a similar abdominal capacity may have the umbilicus at different heights, either at the centre or nearer the pubis, or nearer the epigastrium.
5. The same individuals may have the hypochondria differently developed, and a bi-iliac diameter of different length.

We shall see further on what other morphological conditions these different abdominal forms are associated with. Here it is sufficient to state that these different abdominal forms coincide with different states of nutrition and with different morbidity.

The small belly appertains to withered, thin, and delicate individuals ; the well-proportioned belly to robust subjects of regular nutrition, provided with good musculature, sufficient, but never abundant, panniculus adiposus ; the big belly belongs to individuals originally lymphatic, who may have had scrofulous manifestations, who may also have acquired fairly good health by the successive evolution of the organism, but they are rich in fat, and sometimes very rich ; the long belly, relatively narrow, almost cylindrical, like the thorax above it, is met with in thin and slender subjects with marked intestinal morbidity.

In those of the small belly and in those of the large one intestinal manifestations may occur, but of a very different character, as we shall presently see, the different symptomatology which they present being the natural result of the different morphological condition, as can be deduced investigating other circumstances. Reasoning alone makes us suppose that the symptomatology must correspond to the conditions of greater or less development of the liver, kidneys, intestines, etc., so that one will not be able to understand and value its importance either from the diagnostic or from the therapeutic point of view unless one has calculated the efficiency of the individual organs.

I have little to say concerning the spleen, because it presents so many anomalies of development, and alterations which coincide with different constitutions, with very different morbid states, that it is only by struggling with the greatest difficulty that one can arrive at a conclusion. For this reason I have nothing to add to what all teach and recommend for determining its seat and its development by means of careful percussion.

I believe I can maintain that when one meets with some enlargement of the spleen associated with definite pathological conditions, *without being exactly informed* regarding the state of the organ before the morbid state began, the judgment will not be conformable to the truth, because the morphological data of the abdomen, and especially those connected with the development of the hypochondria, have not been taken into consideration. I have examples of healthy individuals who have the spleen more developed than normal, and some of them also the lymphatic glands—individuals in whom both the spleen and the glands show variations in size owing to different circumstances. Therefore I think it necessary with regard to this argument to exhaust all that which the morphological method can give us for the examination of the spleen.

1. *How to Establish the Development of the Liver.*

For this scope the plexic method commonly followed is insufficient. Those measurements which are generally taken on the vertical lines and transversely, even when they coincide with the real hepatic dulness, give only a partial idea. The form of the thorax and also of the belly being very different in different individuals, it may happen—as it really does—that a liver not very developed presents much surface in relationship with the walls on which percussion is made, and that a liver normally developed presents less of a surface.

We shall be even more convinced of this, remembering the variations of form and dimensions which the normal hepatic gland presents. Two livers may be little or very little different in weight, but, considered in their vertical, transverse, and antero-posterior diameters in relation with the cavity in which they reside, and with the organism to which they belong, they offer marked differences.

Generally the absolute dulness of the liver is said to be limited above by the inferior border of the lung, and to terminate below at the free border of the hepatic organ. Well, inasmuch as the vault of the diaphragm has different proportions and forms, so that the liver projects more or less beneath the pulmonary border according to whether the diaphragmatic vault is higher or lower, it follows that that portion of the liver which can be explored by means of percussion varies in different individuals. Again, one can measure in different persons the same areas of absolute dulness vertically and transversely; but if one pays attention to the fact through which in the same individuals not only the proportion of the vault of the diaphragm, but also the sagittal diameter of the hypochondrium, varies, one comprehends that the criterion deduced from the absolute dulness of the liver has a purely anatomical value, which I would call accidental; while from the exact study of the form of the right hypochondrium in all its extensions in the concrete case, one can rise to a conception more useful to the clinical scope and more scientific regarding the real development of the organ.

We may add that the morbidity itself of the liver contributes to render our results still more doubtful. In reality, the volume of the organ remaining equal, a greater or less extent of hepatic surface may be in contact with the walls which one is percussing. Frerichs, authoritative in the matter, says that the mobility of the liver, as well as its congenital and acquired malformations, constitute our first difficulties in diagnosis.

For all these reasons, while it is necessary to acquire in every individual ideas possibly exact on the development of the liver, besides the pleximetric data, I have sought for others among the morphological ones. I have certainly not arrived at perfection, but I believe that I have added to the ordinary method something which approaches the desired exactness.

I proceed in the following way :

Having first measured the height of the individual, the perimeter of the thorax, the length of the sternum, and having noted the relations which exist between these parts, I measure, as I have said elsewhere, the distance between the base of the ensiform apophysis and the symphysis pubis ; then I establish the difference which exists between the xipho-umbilical and umbilico-pubic portions.

Comparing these morphological data with those of the individual morbidity, I have been able to deduce a rule which I think is important, and it is that the greater the distance between the base of the ensiform apophysis and the umbilicus in respect to the distance between the umbilicus and the pubis, the more relatively developed the liver ; the larger the base of the thorax, which forms the roof of the belly, the greater the development of the liver.

Some examples will make these ideas clearer, and will show, as I have said already, that with practice one can obtain an exact notion of the state of things, even without the necessity of always having recourse to very strict measurement, because one has to do with matters which are self-evident.

I have selected three individuals of the same height as follows :

	1.	2.	3.	Observations.
S. ..	165	165	165	(1) Of robust, muscular aspect ; gourmand ; piles ; hepatic cirrhosis ; atheromasia. (2) Always healthy ; very excitable ; previous pneumonia ; nervous exhaustion through mental excesses. (3) Miserably weak ; bronchial and intestinal catarrhs ; typhoid fever.
Thc. ..	84	82	80	
Stl. ..	15	16	16	
Abl. { *Xu.*	36 { 20	32 { 16	33 { 19	
..	..	..	..	
Up.	16	16	14	
Bi-il. ..	20	19	17	

In these three examples we are struck by the fact of the unequal development of the abdomen, represented in the first by 36 centimetres, in the second by 32 centimetres, and in the third by 33 centimetres. In the first the measurement which would correspond to the ideal type is exceeded by 3 centimetres ; in the second it is diminished by 2 centimetres ; and in the third the measurement corresponds to that of the ideal type.

But, besides all this, the difference that exists in the three individuals as regards the line *Xu* and the line *Up* is natural. In the first the superior section of the abdomen exceeds by 2 centimetres the measurement which would belong to the ideal type ; in the second it corresponds more or less to the normal ; in the third it exceeds this by 2·5 centimetres.

If we now reflect on the observations that correspond to the three individuals taken into consideration, we will see corresponding to each a different morbidity, in which, according to our physio-pathological principles deduced from morphology, is declared the fact which one is in quest of—that is to say, the excessive development of the hepatic gland in the first individual in whom the measure of the upper segment of the belly is excessive.

These examples are sufficient to show the method of morphological research. I would add, however, that in practice the cases vary very much, and the proportions are modified in many ways ; consequently, as regards the liver, we find cases in which the development of the organ and of the parts which appertain to it, anatomically and physiologically, is such that, up to a certain point, it is the index of very active digestive functions, but, at the same time, of corresponding morbidity, which will manifest itself according to circumstances, sooner or later, more or less grave. In other cases, on the contrary, the development of the parts just mentioned indicates a certain tendency in the individual to that morbidity, and this requires the action of causes more intense and more lasting ; or it declares itself more openly in certain morbid conditions, when, through physiological correlations, the liver, and the parts which are in necessary relation with it, are similarly treated, as we shall see in its place.

When we observe individuals, possibly of the same height and the same age, for the purpose of examining the belly, we can see at a glance that the umbilicus is at different heights ; further, among those in whom the length of the line *Xu* is maximal we distinguish also those in whom this maximal length coincides with the greater or less fulness of the base of the thorax, which forms the roof of the hypochondria, and this constitutes another important fact for our judgment.

It is natural to admit that the larger the base of the thorax the larger the space of the hypochondria, and consequently the larger the volume of the viscera. The contrary holds when the conditions are opposite. Therefore our judgment as regards the development of the liver will be founded upon the length of the line *Xu*, and the result of the inspection relatively to the size of the base of the thorax.

But I may be asked, Why have you not tried to determine also the measures of the latter ? And in reality I have done so, but after some time I found that the examination of the form of the hypochondrium is sufficient to complete the value of the xipho-umbilical line. When one knows the thoracic circumference, it is easy to reveal whether the form of the chest at the base is proportionate to the rest or not. Besides, the basis of our judgment is the *Xu* line. What we obtain by inspection of the thorax either confirms or accentuates the morphological fact which we required. The precise confirmation is not necessary, and the notion of the maximal development of the liver which is derived from the maximal fulness of the base of the thorax removes all doubt regarding the fact of our research.

It is certain that there are healthy individuals in whom the upper segment of the belly is not only relatively much developed in the transverse direction, but is also very protuberant and tense, so that it resembles what is observed in some patients suffering from chronic hepatic diseases with morbid development of the hypochondria and epigastrium, and in some of them these regions are divided from the subjacent ones by a marked line. This line either indicates the sharp limitation of the upper abdominal protuberance or consists of a slight cutaneous depression. In all these cases one has to do with patients suffering from abdominal affections in general, and those of the stomach with hepatic symptoms in particular.

There are other individuals with a cylindrical thorax, or tending to cylindrical, in whom the upper segment of the belly, though excessively developed in length, is almost depressed, and the liver does not project beyond the thorax.

We must also mention another circumstance—namely, the breadth of the intercostal spaces of the base of the thorax. These, especially in persons having a cylindrical thorax, may be wider than in others, so that the amount of space enclosed by the ribs is greater than that in individuals not having the same conditions relative to the intercostal spaces. This is not devoid of importance, because if, on the one hand, the fulness of the base of the thorax, which can be contrasted with the idea of a development of the liver greater than normal, be wanting, on the other, one comprehends that what is wanting to the organ in the transverse diameter is gained in the vertical diameter. This circumstance appears even more frequently in women who have the bad habit of constricting the trunk by corsets, disfiguring the natural form, and deranging organs and functions, to follow the fashion. However, some of them, more judicious on the appearance of the discomfort which the corsets cause at the time in which the development of the parts which we are considering takes place, abandon the fashion and leave free play to the organs to adapt themselves according to their morphological requirements. It is only in these one finds what some anatomists maintain—namely, that the transverse diameter of the thorax is proportionately greater in women than in men.

Sometimes we meet with individuals in whom the length of the line Xu is greater than normal, and there is not the above-mentioned wideness in the intercostal spaces. Well, in these cases careful examination of the liver reveals that the edge of this organ projects so much beyond the chest as to make us believe that it is increased in size, while it is that which appertains to the individual, according to his morphological type.

2. *How to Recognize the Development of the Intestine.*

Bichat has observed that some individuals have a longer and larger intestine than others. Experience has shown that the kind of alimentation has great influence on the development of the intestine ; this is confirmed by comparative anatomy. But when we try to discover by means of observation what development the intestines of an individual has reached, we find ourselves in greater embarrassment.

Above all, for proceeding as a good physiological method requires, it is necessary to distinguish three parts in the intestine —namely, the stomach, the small and large intestines. For this reason also our difficulties increase.

I have had recourse to the science and experience of some anatomists for obtaining positive data concerning the development of the intestine; I have consulted the best textbooks of anatomy, but I have not succeeded in procuring from them the ideas which could be the point of departure for instituting my investigations. The data which we possess are extremely vague, as well as scarce and incomplete. One can profit very little by knowing that the alimentary canal from the mouth to the anus measures 10 or 11 metres—that is to say, six or seven times the length of the body; that the small intestine is *about* 8 metres long; that the larger intestine *may have* a length of 1·30 or 1·70 metres, and *even* of 2 metres. One comprehends, then, that in pathology, also, no one has ever attempted to make observations, such as are being made—though following the fallacious rule of the averages—on the heart, liver, kidneys, and so on.

Nevertheless, we must not abandon the idea of the advantage to be got from the morphological criteria for establishing in every concrete case what the development is, when it is precisely from these criteria that one must obtain the notion, possibly exact, of the individual morphological combination—when one must understand the physiological individuality in which took origin those tendencies, those preferences in the selection of food, that particular general nutrition, those habits, those primitive functional anomalies, from which the morbid state gradually arises.

Several times I have mentioned that the intestine is the organ which most easily subjects itself to the law of adaptation. I repeat this here, because we have to make some applications of it.

We have described above three individuals of the same height having a different development of the belly, in whom we have also shown that a different development of the liver exists, according to the following criteria: (*a*) the length of the line *Xu*; (*b*) the largeness of the base of the thorax, by reason of which in each case we can maintain that, apart from the post occupied by the liver, in the remainder of the abdominal cavity an intestinal mass is collected, which is in relationship with the size of the cavity which it occupies. One comprehends that it now remains to determine the mode in which we can form the notion that we are seeking for in an absolute or at least approximate way. In other words, it is necessary to know if there are other data that respond to the morphological basis which we seek, and which, put in relationship with the rest of the organism, will permit at least a probable judgment.

There are three data, in my opinion, which can be utilized: the length of the abdomen in respect to the stature; the length of the line *Up* in respect to the line *Xu*; the length of the *Bi-il* diameter.

The greater the length of the abdomen—the length of the line *Up* and of the *Bi-il* diameter being at the same time relatively long—the more developed the intestine considered as a whole—that is, from the stomach to the anus. This datum is sufficiently exact. I have met with it constantly in individuals who were large eaters and presented a florid appearance; and when it was possible, I have verified anatomically that the intestine was longer in them than in other individuals who had an abdomen less high and the lines *Up* and the *Bi-il* diameter shorter.

Now I have to make a very important observation. The above-mentioned proportions of the abdominal cavity are found in individuals who represent, as we shall see in its place, two very different morphological types—for example, in individuals who have the attributes of a certain robustness, who are well and sometimes richly nourished, who readily suffer from abdominal disturbances, or manifest a disposition to hepatic cirrhosis; and in other individuals who, on the contrary, are weak, ill-nourished, suffer habitually from intestinal disturbances, and are subject to chronic affections of the mesentery and peritoneum.

The difference between these two cases consists in the duplicatures of the mesentery being more abundantly developed in the individuals last recorded, consequently in finding in them the lymphatic system more developed.

We have also another combination of things. The abdominal height may be proportionate to the rest of the person; the two lines *Xu* and *Up* being also in normal proportion with each other, although more frequently one sees the former prevail over the latter, rarely the reverse; and the *Bi-il* diameter absolutely inferior.

This combination is met with in individuals of fair or scarce nutrition ; and, conceding to the line Xu its value in the concrete case, we attribute to the individual an intestinal mass not well developed.

The clinical and physiological observations confirm the opinion founded upon the morphological basis. In fact, we have here two individuals who, as I have said, are endowed with poor nutrition, and may have definite morbid dispositions—individuals who remain always thin, with scarce musculature, miserably weak, but never really infirm ; or individuals who in the different epochs of life may manifest clinical conditions which indicate the special morbidity—that is to say, a disposition to lymphatic, scrofulous, or tubercular diseases. Consequently, here also our judgment on the eventual existence of an intestine, not only little developed, but united with a copious amount of lymphatic tissues in the peritoneal folds—here our judgment, as I have said, must be guided by the morphological datum, which will acquire special signification from the anamnestic facts, carefully and wisely interpreted.

The intestine, as is known, is subject to great changes of form and of size, which necessarily modify the form and size of the belly. By virtue of this, after long observation I am convinced that the measure of the abdominal circumference, though in the concrete case it may help as to the knowledge of certain pathological conditions, does not contribute to the scope of our investigation. This requires not a variable, but a fixed, basis, as are the points within which the measurements of the belly must be made with my method.

I shall now add another observation which supports, in my opinion, the things expounded above, and refers to the size of the belly at its periphery.

Two individuals fall under our observation, both appertaining to that category of organisms which later on we shall learn to know, when we speak of the First Morphological Combination, and whom we shall now represent as two slender types, with infantile precedents indicating the scrofulous constitution, both having had in youth symptoms of broncho-alveolitis, which caused the suspicion to arise of pulmonary phthisis, and proportions of the belly that, as we have seen, indicate a greater development of the intestine. The future of these two individuals, owing to reasons which we shall study further on, gradually becomes very different. In one the manifestations of the respiratory apparatus by degrees diminish, and from year to year the general nutrition assumes a better course ; later one sees a considerable transformation of the organism, the fat accumulates, the belly becomes prominent and enlarged, and the seat of unusual sufferings which, separately or combined with others, endure for the rest of life. In the other, on the contrary, the pulmonary lesions, though they may diminish, never entirely disappear ; the general nutrition remains low ; abdominal disturbances make their appearance, and are gradually increased by the augmented size of the belly. In the former case the belly enlarges with the rest of the soft parts of the organism ; in the latter the size of the belly contrasts with the thinness of the person. The former presents a florid aspect, the latter that of profound suffering. In reality, in both cases there is a pathological manifestation, which, though it apparently differs, considered in the former and in the latter case, has, morphologically speaking, the same point of departure in both. In the abdomen of the individual who presents a healthy aspect one will see a considerable accumulation of fat in the folds of the peritoneum, which are very exuberant ; in the abdomen of the other individual one will see the process of abdominal scrofulosis developed in the mesentery, much increased, and very rich in lymphatic tissues.

These facts, obtained from experience, mean that in the same manner that a person, originally lymphatic, having indications of a greater development of the intestine, will have a voluminous belly through the accumulation of fat in the exuberant peritoneal folds, another person with equal constitutional and morphological conditions will have a voluminous belly through morbid development of the lymphatic elements in the exuberant peritoneal folds. In both cases the increasing size of the belly may occur from excess of production in the mesenteric folds ; in both originally the folds of the peritoneum must have represented a congenerous morphological form. And if we proceed in the analysis of the facts, we will find that the mesentery had an original development greater than it ought to have had ; yet in one we observe, together with the fatness, marked development, both in number and size, of the bloodvessels, especially the veins ; in the other, instead, a special development of the lymphatic tissues.

We will understand the physio-pathological value of these circumstances when we occupy ourselves later on with the morphological combinations as the basis of special morbidities. For the present, returning to speak of that which we can argue from the size of the belly when it is met with in the above-mentioned pathological conditions, I think we can conclude that, eliminating duly other morbid facts which may equally exaggerate the size of the part, we must consider it as the result of abnormal nutrition of the elements which constitute the mesentery, to which, consequently, special morphological conditions must be attributed.

It would be useful if I could enter further into this question to discover what part of the intestine is developed according to the requirements of the case or not ; but, inasmuch as I do not find myself in possession of sound criteria for reaching this morphological determinism, I shall not refer to the results, still uncertain, obtained from my observations.

3. *Rules, founded upon Clinical and Anatomical Observations, for judging the Development of the Liver, Kidneys, Vena Portæ, and Vena Cava Inferior.*

I must begin with an explanation. From the things which I shall expound, it will appear clear that when one verifies a definite morphological combination in an individual, above all one must find out whether proportionate development exists in the skeleton and in the central circulatory apparatus ; and experience teaches, on the other hand, that when the due proportions of development exist, the arterial tree in its visceral and peripheral expansions bears itself in a comformable way. The same may be said of the cases in which one meets with, relatively to the personal development, a defective evolution of the arterial circulating apparatus ; its visceral and peripheral expansions are also incompletely developed. As is proved by anatomical and clinical observations, the peripheral arterial circulation corresponds to the type of development of the central circulatory organs, according to whether these are normally, or defectively, or excessively developed.

The same cannot be said of the venous tree. Whether or not the arterial tree be proportionately developed in respect to the whole organism, the venous may be more or less excessively developed as a whole, or especially in some parts of the body. If we examine three or four individuals of the same skeletal height, in whom the development of the heart proportionate to the cardiac index has been recognized, and take into consideration the whole of the venous system from head to feet, we will be able to verify three different kinds of venous development: in one we can barely perceive the principal veins of the individual parts; in the second we see a larger number of veins, more or less apparent; in the third we find an example of excessive venous development. *These facts are observed in* MANY CASES, *especially when the heart and the arterial system are defectively developed, and the right heart is developed more in proportion than the left. I have said in* MANY CASES, *because in others, instead of the excessive development of the venous system, we have the coincidence of the excessive development of the lymphatic system and kindred tissues.*

1. *What is the relationship of development of the liver and of the kidneys? What is the relationship of calibre of the inferior vena cava, the vena portæ and the emulgent veins in individuals who have* EQUAL SKELETAL HEIGHT ?

In those in whom the xipho-pubic line is greater than the normal in the concrete case, and is proportionate in its two portions—that is, the xipho-umbilical and umbilico-pubic—together with a *big chest*, but *relatively low*, owing to which the development of the *liver*, considered either in its weight or in its diameters, is greater than the normal, the *vena cava inferior is proportionate* to the development of the liver; the *vena portæ* is relatively greater than normal. The *kidneys* are in relationship of development with the liver and with the vena cava inferior. The *emulgent veins* are very frequently unequal with one another. They must be considered together, and then one sees that they resemble in their development that of the vena cava inferior.

If the size of the thorax corresponds to the skeletal height, and the xipho-pubic line is in proportion with the rest, but the xipho-umbilical portion is longer than the umbilico-pubic, then the *liver* and *kidneys* in their weight and diameters are more developed than the normal. The lumen of the *cava* is relatively larger, that of the portæ is relatively *smaller*. The *emulgent veins* are unequal with one another; considered together, they are proportionate to the development of the cava.

The more marked these relations, and the greater their importance physiologically and pathologically, the greater the size of the belly, the greater the prevalence of the xipho-umbilical line over the umbilico-pubic, and the more developed the venous system of the legs.

The height of the skeleton being equal, in those in whom the size of the abdomen is relatively greater through the excessive development of the hypochondriac regions, and the xipho-umbilical line longer than the umbilico-pubic, the size of the *liver* and of the *kidneys is proportionate* to the development of the abdomen and to the prevalence of the xipho-umbilical line. In those in whom the size of the abdomen is relatively small, the development of the *cava* is relatively greater in the cases in which, the skeletal height being equal, the xipho-umbilical line is proportionately longer than the umbilico-pubic. The *vena portæ* does not exhibit variations which could be positively referred to definite proportions of development of the parts just mentioned. On the basis, however, of some clinical and anatomical coincidences which I have observed, I can maintain that a kind of antagonism exists between the development of the vena portæ and that of the folds of the peritoneum. In this connection it is advisable to remember what I have said in the preceding section concerning the different general conditions of the organism as regards the prevalence of the development of the blood-vessels, especially the veins, and of the lymphatics in the mesentery.

2. *What is the development of the liver, of the kidneys, and the calibre of the vena cava inferior, of the vena portæ, and of the emulgent veins in individuals with* DIFFERENT SKELETAL HEIGHT, *but having* EQUAL LENGTH OF THE XIPHO-UMBILICAL LINE ?

When the skeletal height, the proportions of the thorax and of the length of the abdomen, are different, the length of the xipho-umbilical line being equal, we find—

That the weight and volume of the liver are less in those in whom the size of the belly is relatively less, and especially when the xipho-umbilical line is less in proportion than the umbilico-pubic line ;

That the *vena cava inferior* is relatively larger in those in whom the skeletal height is very high, and, above all, in those in whom the xipho-umbilical line prevails over the umbilico-pubic ;

That the *vena portæ* is larger when, whatever may be the height of the skeleton and the development of the chest, the size of the belly exceeds the normal limit, especially owing to the prevalence of the bi-iliac diameter ;

That the development of the *emulgent veins* corresponds to that of the vena cava inferior ;

That the development of the *liver* in individuals unequal in skeletal height, but equal in the length of the belly, is greater in those of them who have a relatively shorter skeletal height. The same may be said of the *kidneys*. These relations are accentuated in proportion to the greater length of the bi-iliac diameter.

3. *What is the development of the liver, of the kidneys, of the vena cava inferior, of the vena portæ, and of the emulgent veins in individuals having different relations of development in all, but* EQUAL LENGTH OF THE UMBILICO-PUBIC LINE ?

The *vena portæ* is absolutely larger in those in whom the umbilico-pubic line prevails over the xipho-umbilical, as well as the bi-iliac diameter.[1] This confirms indirectly the foregoing facts, because what regards the development of the liver, kidneys, and cava in this case repeats precisely what has been said above—that is, the *liver*, *kidneys*, and *vena cava inferior* are in relationship with the development of the skeleton and of the abdominal length. For greater clearness, I wish to add that when I contrast the development of the vena cava inferior with the skeletal height, I specially refer, as a rule, to the lower half of this, and to the degree of development of the relative soft parts.

4. *What is the size of the liver, of the kidneys, of the vena cava inferior, of the vena portæ, and of the emulgent veins in* INDIVIDUALS HAVING DIFFERENT PROPORTIONS IN ALL, BUT EQUAL ABDOMINAL LENGTH ?

If the abdominal length be equal, but with the xipho-umbilical line prevailing, we find the *liver* and *kidneys*, and also the *vena cava inferior* and the *emulgent veins*, developed in proportion.

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[1] I would refer the reader to the observation previously made on the greater development of the intestine which coincides with the greater relative length of the umbilico-pubic line.

The *vena portæ* is relatively less developed if the xipho-umbilical line prevails, but it is more developed if the umbilico-pubic line prevails. Besides, it is necessary to remember what I have said concerning the manner of judging the length of the intestine and the development of the mesentery, because when the judgment of the development of these parts has been made previously, one will much more readily perceive the relations of development between the different parts which have occupied our attention up to now.

5. *What is the development of the liver, of the kidneys, of the vena cava inferior, and of the vena portæ, and of the emulgent veins*, IN INDIVIDUALS WHO DIFFER FROM ONE ANOTHER IN ALL THE OTHER PROPORTIONS, BUT HAVE AN EQUAL LENGTH OF BI-ILIAC DIAMETER ?

The bi-iliac diameter, with its greater or less development, may coincide with different proportions of the belly, referable both to the whole length of the xipho-pubic line and to the different length or the equality of the portions which compose it.

In those in whom we see the bi-iliac diameter absolutely prevail, it may contribute either to the signification of the prevalence of the xipho-umbilical line or to that of the umbilico-pubic. Consequently—

Of two individuals having equal skeletal height, equal thoracic development, equal abdominal length, but *different bi-iliac* development, one can say that in one the belly is more ample, in the other relatively less ample. But if in one case the greater length of the bi-iliac diameter be associated with the predomination of the xipho-umbilical line, and in the other with that (much less frequent) of the umbilico-pubic line, one can infer that the signification of these morphological relations is accentuated to the extent which is indicated by the degree of development of the bi-iliac diameter. The same can be said if this line be absolutely shorter, which rarely occurs.

I shall conclude these data by referring to a very important anatomical fact, which is the relationship of development which exists between the heart, the vena cava inferior, and the liver.

In individuals in whom there are morphological data for recognizing a relatively greater development of these parts, the more one can conform one's judgment as to finding the heart relatively larger than normal through the primitive excessive development of its right half ; and, otherwise, in those in whom, by the morphological examination of the heart, one recognizes a predomination of its right half independently of pathological conditions, one can deduce that in the above-mentioned parts will be found corresponding morphological relations.

If the foregoing facts required further explanation, I might have included here the tables of the observations which I have made, and the very numerous figures which I have collected with much labour, and have fully studied. But I think they do not ; and besides, if I had included those tables, I would have been obliged to print others even more extensive to treat equally every question which I have studied on the same lines, and this would increase considerably the size of this book, which I wish to keep within reasonable limits.

I shall add instead some other useful notions. In many cases, whose history I know minutely, I have noted a marvellous correspondence between certain morphological conditions and certain habits and morbid tendencies ; and in other cases, which were shown to me by him whose duty it was to take the measurements of the body and of the different organs, I, from the valuation of these measures, argued that which referred to the special individual morbidity. And this was naturally controlled by the history of each case.

Inasmuch as all this is the fruit of long years of observation and meditation, it is not the case of attributing to me too great hurry in arriving at a conclusion, or too much enthusiasm for an idea. I can say that I have taken a long and fatiguing journey, and that I have overcome the discouragement which I felt every time that I had to turn back on my footsteps, so as not to diverge from the narrow path of experimental logic. Therefore, although I felt it my duty to publish the result of my work, making due reserve concerning some particulars, as I have said when dealing with them individually, I equally feel that the clinic can progress by adopting the method which I have followed, because it is naturalistic. Much that I cannot refer to now I shall speak of when dealing with the special morbidity that must be attributed to the different morphological combinations. Meanwhile, to confirm what precedes, I close this argument, observing that by this method I was led to the study of the pathology of the vena cava inferior, and I believe that with this I have added a new chapter to internal pathology, which can be read in my *Commentari di Clinica Medica*, vol. i. Part Special (Tip. Draghi, Padova).

PART IV

APPLICATION OF THE METHOD, AND EXPLANATION OF THE FUNDAMENTAL AND MORE FREQUENT MORPHOLOGICAL TYPES

I. EPILOGUE OF THE GENERAL PRINCIPLES OF MORPHOLOGY AND PHYSIO-PATHOLOGY, CONSTITUTING THE KEY OF THE METHOD.

FOR applying and interpreting the results of the morphological examination of the individual, it is necessary to follow some general principles, which I shall now describe. They are obtained from experience—or, more correctly, sanctioned by experience.

1. Embryology teaches that *the development of the vessels, and that of the viscera to which they appertain, and that of the visceral cavities in which they are contained, are proportionate to one another.*

2. Physiology demonstrates that *the absolute and relative maximum function of an organ is in relationship with its development, because the blood is attracted to and expelled from it in greater quantity and with increased energy.*

3. Anatomy, physiology, and pathology teach that relations exist between the arterial, venous, and lymphatic circulations in a part of the organism and in the whole of it ; and physio-pathology specially shows what morphological results are derived from these circulatory relations. Therefore one comprehends that *the conditions of development of the arteries, veins, and lymphatics of the organism, or of some part of it, which are found in individuals, represent elements which unite in constituting differently the special morphology, consequently the special internal*

environment and the special morbidity in individuals or of their parts.

4. Physio-pathology demonstrates that *both the absolute and relative excess or defect of development and of function of an organ or of an apparatus establish an absolute or relative degree of morbidity, according to the principle of the functional correlations.*

5. The natural history of the higher animals, especially the physiology and pathology of man, *show the great importance of the nervous system in directing the hydraulic currents and in influencing the nutrition and function of the parts composing the organism. From the physiological phenomena, separately considered, as well as from the morbid systems referable to different pathological states, we have necessary expressions of the metamere of the central nervous axis.*

6. Experience has verified, and the science has demonstrated, not only that *every individual represents a morphological variation, but also that in every individual, through the phases of life, special morphological modifications manifest themselves as the inevitable effects of the functional correlations and of the influences of the external environment.*

The first three of these propositions enable us to understand the morphological variation which every individual represents, and points out to us the way for recognizing it in the concrete case.

The others explain the necessity of its special morbidity, and direct us to verify its morphological substratum.

All the six propositions, which contain, I can say, general physiology and pathology, teach us the arguments which help to illustrate the pathogenesis of all those morbid states or morbid acts to whose manifestation what is called *individual predisposition* contributes.

All the things described up to now—as well as others which, for the explanation of the former, I shall expound later on—have a large basis of sound clinical experience. The method which I follow has its root and inspiration in this. Clinical experience, in the presence of the marvellous accord which is gradually showing itself between the more grandiose facts of human pathology and the newest axioms proclaimed by the brilliant progress of natural history, enables one intuitively to perceive it. The parts which compose the method are legitimate inferences from it, but always sanctioned by experience.

In reality, every physician knows well how to distinguish certain constitutional types classically described, and how to attribute to them that definite morbid character which, sooner or later, manifests itself with special symptoms. To all are known those individuals with bodies deformed by a small thorax, big belly, etc., besides those who may be called types of beauty and resistance. But when one wishes to explain the judgment which he forms concerning the different constitutional types on the present and future of the individuals, for various reasons judged disposed to morbid manifestations, one affirms according to empiricism, or decides with phrases which indistinctly declare two factors—that which the individual is, and that which he can be in the future, being able to change himself.

Well, to-day we have to make a step forward : we wish to analyze the constitutional type in its morphological factors ; to discover the chief or secondary importance of each ; and to see almost all in act, for understanding their complex function and rising, if possible, to the rational prescription of the method of preventive treatment or of the treatment of the disease, according to the cases. Both for what it is and for what it may be in the future, one searches for the scientific reasons and the criteria for recognizing it ; we must no longer be satisfied with suspecting what it is now, vaguely imagining what it will be, but we must explain why it is so—why and how it can transform itself.

II. First Morphological Combination.

I call the ensemble of the morphological attributes which may be met with in an individual *morphological combination.*

I prefer it to the expression *morphological type,* because the word "type" is employed for expressing an ensemble of characters which are considered invariable, and which appertain to a definite group of beings. Inasmuch as the morphological characters are, on the contrary, very variable, and the pure and constant types are extremely rarely observed, I think that the word *combination* expresses more precisely the natural fact.[1]

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[1] I hold to the interpretation of the word *type* which passes in anthropology. The type of a series of individuals is not a reality, but the product of a mental work—an abstract idea (Topinard, *loc. cit.*, p. 193). The word *combination*

When we have learned to know the different *Combinations*, we shall be able to construct the theoretical or ideal types, if necessary, according to the requirements of the scientific discussion.

The order which I adopt in the explanation of the combinations is, consequently, preordained according to a scientific but quite arbitrary conception.

The formula of the First Combination is as follows :

$$\begin{array}{ll} \text{S.} & < \text{Ga.} \\ \text{The.} & < \frac{1}{2}\ \text{S.} \\ \text{Stl.} & < \frac{1}{5}\ \text{The.} \\ \text{Abl.} & < \frac{2}{3}\ \text{The.} : \text{Xu.} > \text{Up.} \\ \text{Bi-il.} & < \frac{4}{5}\ \text{Abl.} \\ \multicolumn{2}{l}{\text{Heart } \textit{small.}} \end{array}$$

In this case we are struck by the fact that the transverse diameter or great aperture of the arms (Ga.) prevails over the stature (S.). Well, I have found this constantly in individuals endowed with special nervous hyperexcitability or markedly erethistic ; besides, it is met with very frequently, inasmuch as nowadays the number of exceptionally excitable persons is very considerable.

My observation acquires greater importance owing to its physiological signification being confirmed by the following data of Riccardi : Between the great aperture of the arms and the stature of man there is a constant relationship. It is proportionately greater in monkeys than in man ; it is greater in negroes, negritos, and Papuans than in the Caucasian races. The great aperture of the higher classes is almost constantly superior to the normal average great aperture, and that of the working classes is almost constantly inferior to it.[1]

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in chemistry signifies, as is known, the union of several bodies, from which results another body endowed with special properties. Transferring the word into our field would mean the union of several morphological elements from which an organism endowed with special properties is formed. I believe, therefore, that the phrase *morphological combination* can be introduced into our scientific language.

[1] Riccardi, *Studi intorno all'accrescimento della statura, in ispecie nella città e nei dintorni di Modena* (*Arch. per l'Antrop. e l'Etnolog.* of Professor Mantegazza, vol. xii.).

Weisbach states that prognathous races are lower in the human hierarchy than orthognathous races ; and that the same can be said of those who have arms longer than their legs. Therefore the prognathous races with long arms are the lowest of all (*Die Körpermessungen verschidener Menschenrassen.* Berlin, 1878).

It is useful to mention also in this case our axiom—namely, that which represents an anomaly of evolution indicates a possible morbid predisposition.

In reality, I have found only in a few cases the transverse diameter or the great aperture inferior to the stature; in these cases, also, one had to do with poor persons who suffered from different nervous affections. It would not be devoid of interest to investigate if the difference between my results and those obtained by Riccardi was a differential ethnological character between the inhabitants of Emilia, for example, and those of Veneto. In this Second Edition I can fully confirm what I have said.

Together with the excess of the transverse diameter there may also be an excess of the lower limbs.

As a rule, these exceed the upper limbs in length by 12 centimetres. This difference does not correspond to that indicated by the anthropologists, because their method of measurement is different.

In order that our judgment on the morphological fact may be as nearly as possible conformable to the truth, it is necessary to distinguish the following cases:

1. The limbs exceedingly developed in length, but proportionately well provided with muscles.
2. Provided with thin muscles.
3. Provided with muscles excessively developed.

In these data we have units of anatomical and physiological criteria for enabling us to value certain factors of the embryonic and successive development of the individual, and to discuss the morphology of the spinal axis.[1]

I am far from the idea of wishing to see characters of zoological hierarchy in the length of the arms and legs. I know that the more recent anthropological researches are opposed to it. It is, however, necessary to mention the facts, because they lead to the conception of the harmony, or the want of harmony, in the development of the parts, which in its turn leads to physiological applications of some importance.

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[1] The anthropoids have the upper member longer than the lower, and this is a character of undeniable inferiority which deserves this epithet when it presents itself in man (Topinard, *loc. cit.*, p. 1037). As to the lower member, it is longer than the upper in the black tribes of Africa and Oceania; therefore, when this is met with in man, one has a right to consider it a criterion of inferiority. In the Tasmanians the superior extremity is shorter; in the yellow races, also, it is sometimes shorter, never longer. In this connection Topinard sums up as follows: The negro has the superior limb longer, more simian, owing to the development of the radius only; and he has the inferior limb longer—that is to say, less simian—through the development of the femur. The yellow races have the superior and inferior limbs shorter. Notwithstanding this, one cannot admit a general law.

Discussing the limbs, one sees that these, by virtue of their skeletal and muscular development, as well as of their form, represent mechanical functions of different capacity, through which they lend themselves better to different kinds of exercise. And, according to the way in which individuals conduct themselves in the selection of the work to which they are destined, different consequences, depending upon the kind and amount of work, or upon the functional effort may manifest themselves.

In the concrete case of the First Morphological Combination the limbs are longer than normal, provided with thin muscles, but sometimes capable of energetic function. If the muscular development be unequal, the function is performed with different energies of activity in the relative spinal centres. Hence the phenomena of nervous excitability which is observed in this Morphological Combination, besides that of the unequal distribution of the energy and of the nervous resistance.

And what we have said regarding the limbs holds good also for the thorax. This has not reached the necessary capacity proportionate to the requirement of the whole organism, not taking into consideration the average which is conventionally accepted, but which does not possess a positive value.

The chest being small in respect to the personal height, one must admit that the primitive development of the pulmonary organ was defective, owing to the blood-forming element having been scarce.

Later, during extra-uterine development, when all the blood coming from the right ventricle has to pass through the lungs, the blood encounters there resistance which obstructs the passage of the necessary quantity of blood in the unit of time ; consequently, a degree of intrapulmonary pressure greater than that of the intrathoracic pressure is established.

The consequences depending upon this primitive hydraulic disturbance are several—sometimes in a degree which passes unobserved ; at others in even a less degree, which may be suppressed by the effect of the functional correlations, as we shall see ; at others, on the contrary, they gradually become more marked, owing to morbid phenomena.

Meanwhile we note, theoretically, that the increased pressure in the pulmonary dominion slackens the exchange of gases through the respiratory organ, slackens the deflux of venous blood, and the course of the lymph in the lymphatic vessels ; therefore we will have a relatively high pressure in the veins and lymphatics, with all the necessary consequences in the biochemical relations, consequently in those of cellular life, of the local environment, of the resistance of the organ, etc. In the right ventricle, also, phenomena of augmented internal pressure will occur. The liver and kidneys, which play such an important part in the balance of the organism, will in their turn be subjected to the influx of the above-mentioned hydraulic conditions, together with circulatory disturbances connected directly with these organs.

In such contingencies, in all these organs and parts of the body, there is a corresponding degree of morbidity, which, as is natural, may be either mitigated or increased by the ordinary circumstances of life.

In the case in question, the small capacity of the thorax is confirmed, not only by its relation with the personal height, but also by the sternal length being equal only to one-fourth of the thoracic circumference. To compensate this defect of circumference, the sternal length would require to be greater, as it is in a considerable number of the cases.

The abdominal length, instead of being equal to twice the sternal length, is equal only to one and two-thirds.

Here it is necessary to institute two relations—namely, with the chest and with the organism as a whole.

Compared with the former, the abdomen requires one-third more to be proportionate ; but, compared with the whole organism, the defect of the belly is greater. In this case one can maintain that the abdominal organs, the preparers of the materials of absorption for nutrition, are inferior both in development and function to the degree which would be required for a vigorous and abundant assimilation ; but, at the same time, it is necessary to admit that the defect noted in the belly will contribute to the above-mentioned conditions relative to the thoracic development when the consequences of the morphological disproportions of the chest are more or less slow in presenting themselves.

But in the belly we must consider another fact : the xipho-umbilical line is longer than the umbilico-pubic line. The ideal type requires that both should be equal. This kind of disproportion means that the organs which occupy the superior section of the abdomen, owing to causes of primitive formation, increased, or at least maintained, by the intrapulmonary hydraulic conditions, have acquired a greater development in respect to those that occupy the inferior section.

Having thus analyzed the case, we shall now try to summarize the value of the facts.

Morphologically : Thorax deficient ; abdomen deficient ; disproportionate development by excess of the limbs ; scarce musculature.

Physiologically : Respiratory insufficiency ; low intrathoracic pressure ; trophic functions in general languid ; intravenous pressure relatively greater, and relative consequences in the parenchymatous organs, lymphatics, and mucosæ ; nervous erethismus.

Pathologically : Morbid dispositions which modify themselves through life ; in infancy the glandular lymphatic phenomena predominate ; then the catarrhal, especially of the aerial passages ; later those of the digestive tract, with possible hæmorrhoidal manifestations—all which facts are in part favoured, or even exaggerated, by the functional anomalies of the nervous system.

Our morphological examination is not yet finished. I have purposely omitted to speak of the heart and of the vascular system in general, because in the plan which I have sketched this is the suitable place for seeing how its very important function is exercised.

The heart in the concrete case, like all the rest of the musculature, is somewhat deficient in its development as a whole ; considered in its parts, the right half is frequently relatively greater than the left. The whole of the arterial tree likewise suffers from this relative defect of development.

From what I have already stated concerning the morphological examination of the heart, one will readily comprehend the value of these data.

In the difference of development of the two ventricles we see the effect of the resistance that the right ventricle has had to overcome in the province of the pulmonary artery ; while in the defective development of the left ventricle we see one of the causes which have influenced the defective evolution of the arterial system. To sum up, one can say that the heart has contributed to the maintenance of the general conditions of the organism both morphologically and pathologically.

It is very evident that if, during the individual development, the heart had increased its diameters by progressive enlargement of mass, as in other cases observed, and if, above all, the left ventricle, with greater energy at each systole, had pumped into the arterial tree a larger quantity of blood, while the abnormal pressure in the dominion of the pulmonary artery and in the venous tree had become somewhat lowered, the arterial pressure and tension would be higher, with the result of a more regular and more active procedure of the functions of nutrition.

Neither scholastic subtlety, nor powers of imagination, nor special knowledge, are necessary for comprehending all this, and it is sufficient to remember what occurs in any patient whatever when, in consequence of pathological motives, the hydraulic conditions are modified in such a way as they are found in the case under consideration, owing to reasons of primitive organization. Through this I am convinced that certain morbid states are denoted by some special notes or anatomical lines, in particular morphological types, in such a manner that studying some one will understand better the others; this will be made more clear by analyzing other morphological combinations.

Meanwhile, in the concrete case we must admit that the morphological, physiological, and pathogenic conditions observed were confirmed, or even increased, by the fact that the heart, not having adapted itself perfectly to the requirements of the law of functional correlations, did not reach that degree of development nor that amount and kind of functional capacity which would have been able partly to suppress them. We must also admit that it is only after having obtained these data that we can form a better idea of the individual constitution. With regard to this, I wish to make a brief digression.

All these data, and others still, as we shall see immediately, must give us the conception of the individual constitution, and it is very natural if I cannot name it with one or other of those predicates which have been, and are still, commonly employed for giving a general synthetic idea of the corporeal qualities of the individual.

Weak constitution generally might be attributable to the case under examination ; but in the course of our study we shall find many other cases to which the same denomination can be applied. And, comparing all these cases with one another by means of the morphological criteria that we intend to apply to the examination of the patient, we shall meet with many individual differences, by virtue of which we shall feel the necessity of indicating other terms which specify better the constitution in the concrete case.

The same can be said for the opposite expression, *strong constitution,* in which are contained somatic manifestations of appearance, *not always* responding to the conception of strength, for at times they coincide with contrary manifestations, and even the cases are not wanting in which, notwithstanding the somatic appearances and the relative manifestations of constitutional strength, we have morbid manifestations precisely responding to the morphological error which has escaped detection during the superficial examination of the individual.

To-day, when one wishes to delineate the constitutional character of the patient under observation, phrases are used which, to speak the truth, contrast with that positive character which we desire to give to every investigation of ours. One says, for example, *Constitution good,* or *healthy, robust,* and all this is founded upon an observation, not only superficial, but even opposed to the anamnestic facts, if they have been carefully obtained, or to the morbid picture in progress, which is due more to the special predispositions of the individual than to the supposed external causes.

At other times, to the phrase which denotes the kind of constitution is added another which is intended to correct the too absolute signification of the former. They read more or less as follows : The individual has a good constitution, but some manifestation is not wanting which denotes his weakness, or some weakness or susceptibility of one part or another ; he is of sound constitution, though he readily suffers from catarrhal conditions of the chest, or of the intestine, etc. I would observe that thus doing, one asserts what is not ; one takes the appearance for the reality. When one classifies nervous susceptibility coexisting with a good visceral organization ; when the visceral defects are found with a resistant, energetic, well-balanced nervous system—in all these different methods of classifying the organisms the reality is required, which consists truly in the necessity which we feel of recognizing it in the fact of the individual organization, and of precisely indicating it by formulæ possibly exact.

The obscurity of the language and its indefiniteness correspond precisely to the vague conceptions which one has, and to the doubt which accompanies their application.

It is necessary to confess, however, that the old doctrine of constitutions and temperaments is not to be allowed to fall into oblivion. At least in its fundamental idea—since it expresses the necessity of qualifying the individual according to the general attributes of his body and those special to the parts which compose it—it was more useful than the formulæ that subsequently came into use. That doctrine aimed at making known what, by means of a better method, we wish to specify precisely—that is to say, how the various parts of the organism are associated with one another, which of them predominate, and what morbific effects originate from them.

If we reflect on the results of our morphological examination, we will be convinced that the efforts of the old pathologists were suggested by a sound naturalistic conception—that of taking into consideration the organization, and discovering in it all that which in the special organization could be considered as morbid predisposition, and coinciding with the morbid manifestations in progress. Just as I do not believe that we must recall to life the formulæ of the old doctrine, so also I do not believe that those which have substituted it are useful to the clinic, which wishes to be truly positive ; hence, in founding the basis of the diagnosis, strictly scientific elements must be employed.

For this reason, I believe that those vague scientific terms used to signify the different constitutions of the individual cannot be retained. They should be substituted, when one has to deal with them, by the succinct and exact exposition of the principal morphological findings. It is by this means alone that one can indicate, if necessary, or if one wish, the general characters of resistance, of more or less weakness, excitability, etc., that serve to disclose still better the special individuality with which one has to deal.

When one has been educated to this method of morphological analysis, one will comprehend its importance every time that, all the factors of the organism being suitably arranged, one sees its past and its possibilities displayed before one in its principal lines. This does not happen with the simple enunciation which is employed, qualifying an individual as being of healthy or strong or weak constitution.

And this I affirm on the basis of clinical experience, not rarely controlled by my hearers, when, with the scope of practical education and of demonstration of the value of the morphological method, before having obtained the anamnestic history, I have explained the signification of the morphological data, which the anamnesis subsequently confirmed, either in the verification of physiological attitudes or in the pathological determinations of the patients.

In the following table of examples, which refer to the *First Combination*, one will see the constant harmony which obtains between the individual morphological value and its morbidity.

The number of my observations increases from day to day; but I have given only a very limited number in the table, because I have deemed it superfluous to increase the size of the book, registering similar facts, whose morphological and clinical signification which interests us most can be known from the examples given.

Examining this table, one sees—

1. That the patients who were affected with tuberculosis and broncho-alveolitis presented uniformly defective development of the thorax, except Cases 7 and 10, which were included in the table for the purpose of revealing more clearly what is characteristic of the First Combination.

2. That in all the heart had not reached regular development, the right ventricle being larger than the left, or the whole heart relatively small. Case 7, in which the heart was very small, apparently presents itself as an exception to the rule, for the diagnosis is simple chronic catarrh; but we shall see later on that in reality it is a confirmation of it. Case 10 confirms the rule splendidly in an indirect way, when one considers that the diagnosis of tuberculosis, suggested by the chronic course of the symptomatology, was placed in doubt owing to the morphological data referable to the chest and heart—a diagnosis which was

TABLE XVII.

EXAMPLES REFERRING TO THE FIRST MORPHOLOGICAL COMBINATION.

	Morphological Combination.	Pathological Conditions.		Morphological Combination.	Pathological Conditions.
1. F. MAINARDI ..	S. .. .. 147 Ga. .. .. 151 Thc. .. .. 72 Stl. .. .. 14 Abl. 26·5 { *Xu.* 15 *Up.* 11·5 Bi-il. .. .. 22 Heart : *Vr.* > *Vl.*	Maximal slenderness, frequent rhinorrhagia, always pale and thin. Some skeletal proportions; hands and feet very developed; subcutaneous veins extremely developed. *Pulmonary tuberculosis;* disproportionate size of the liver in respect to lung affection.	6. A. MARES ..	S. .. .. 161 Ga. .. .. 193·3 Thc. .. .. 83 Stl. .. .. 17 Abl. 35 { *Xu.* 20 *Up.* 15 Bi-il. .. .. 27 Heart small.	Nervous erethism; from twelve years of age proclivity to laryngo-bronchial catarrh; at every slight disorder febrile state; large eater; liver very developed; always thin. *Pulmonary tuberculosis.*
2. E. ZANETTI ..	S. .. .. 141 Ga. .. .. 137 Thc. .. .. 69 Stl. .. .. 13 Abl. 28 { *Xu.* 14 *Up.* 14 Bi-il. .. .. 22 Heart : *Vr.* > *Vl.*	Lymphatic aspect, always inclined to catarrh, especially of the respiratory passages. Digestive organs fairly healthy. Never nasal hæmorrhage. Considerable nervous resistance. *Disseminated broncho-alveolitis.*	7. A. MISSERO ..	S. .. .. 172 Ga. .. .. 179 Thc. .. .. 86 Stl. .. .. 17 Abl. 34 { *Xu.* 20 *Up.* 14 Bi-il. .. .. 25 Heart very small.	*Chronic bronchial catarrh and bronchiectasis;* extreme wasting, almost marasmus. The heart, apart from considerable dilatation of right half, very small.
3. R. BASSO ..	S. .. .. 150 Ga. .. .. 150 Thc. .. .. 67 Stl. .. .. 14 Abl. 29 { *Xu.* 15 *Up.* 14 Bi-il. .. .. 23 Heart rather small.	Lymphatic, torpid, almost always tumidity of the belly; glandular swellings; cicatrices from chilblains in hands and feet. *Primary tuberculosis of the glands, secondary of the lungs.*	8. T. CASTALDI ..	S. .. .. 144 Ga. .. .. 144 Thc. .. .. 86 Stl. .. .. 12 Abl. 30 { *Xu.* 16 *Up.* 14 Bi-il. .. .. 25 Heart small.	Usual precedents of weakness of the body; abdominal, menstrual disturbances; *broncho-alveolitis of both apices.* Frequent attacks of dyspnœa through cardiac dilatation.
4. F. MINOZZI ..	S. .. .. 154 Ga. .. .. 158 Thc. .. .. 67 Stl. .. .. 13 Abl. 32·5 { *Xu.* 20 *Up.* 12·5 Bi-il. .. .. 25 Heart : *Vr.* > *Vl.*	Pot-bellied, fat, muscles soft; irritable; frequent attacks of indigestion; liver tumid; urine high-coloured, rich in urates very frequently; habitual bronchial catarrh. *Partial secondary pleuritis; disseminated broncho-alveolitis.*	9. L. GAZZAGO ..	S. .. .. 165 Ga. .. .. 175 Thc. .. .. 80 Stl. .. .. 15 Abl. 27 { *Xu.* 18 *Up.* 11 Bi-il. .. .. 23 Heart small.	*Pulmonary tuberculosis.* Among the notable symptoms, gastro-enteric catarrh, hæmorrhoidal turgescences; liver tumid and painful.
5. M. RANGO ..	S. .. .. 145 Ga. .. .. 125 Thc. .. .. 65 Stl. .. .. 12 Abl. 24 { *Xu.* 12 *Up.* 12 Bi-il. .. .. 24 Heart : *Vr.* > *Vl.*	Dyspeptic, miserably weak, without ever being obliged to keep to bed; palpitations frequently; bronchial catarrhs, with some streaks of blood at time of first menstruation; apparently good health for some years, then *broncho-alveolitis* and *pulmonary tuberculosis.*	10. P. MAGGIATO ..	S. .. .. 171 Ga. .. .. 182 Thc. .. .. 96 Stl. .. .. 18 Abl. 40 { *Xu.* 26 *Up.* 16 Bi-il. .. .. 18 Heart proportionate.	Chronic bronchial catarrh, laryngeal catarrh, dulness of right apex, partial secondary pleuritis, notable wasting. *Diagnosis of pulmonary tuberculosis, founded upon physical symptoms, rendered very doubtful by the morphological data, contradicted by final diagnosis of echinococcus disease. Cure.*

subsequently contradicted in the most formal manner by the spontaneous evacuation of echinococcus cysts through the aerial passages and by the subsequent cure.

3. That the development of the belly in comparison with the rest of the organism explains the reason of the physiological and pathological facts through which individuals affected by the same disease have offered different peculiarities as regards the conditions of general nutrition.

4. That in different individuals either the defect of development of the heart (Case 9) or that of the abdomen (Case 1) has greater or less importance in favouring these special internal conditions, or of the organic environment, which constitute the morbid disposition of the organism or of the organ, besides the reason determining the prevalence of some symptoms in the disease.

We see, for instance, in Case 1 the line Xu proportionately very developed, and the hepatic enlargement prevailing. This, for those who know the many sufferings which are connected with hyperæmia of the liver, is sufficient to indicate the fact, because it reminds them of the special dyspeptic forms, the hypochondriac disturbances, venous stasis in the intestines, hæmorrhoidal turgescences, fistulæ in ano, besides the many other sufferings which the morbid condition of the liver indirectly provokes, either by means of the blood-crasis or of innervation.

But what is more important to reveal is the fact of the coincidence of the greater development of the line Xu with the *disproportionate size of the liver*, which presents itself not only as a morbid phenomenon, but also as a special morphological condition that the morbid fact may increase, but it does not depend upon it altogether. It, in reality, is not found equal in all the cases ; it is not in relationship with the extension of the lung disease, because it may accompany relatively slight pulmonary alteration, and may be absent in cases in which this is greater. It treats precisely of an hepatic development relatively greater than it should be in the individual.

This condition in these cases presents itself as a predisponent to symptoms complicating the pulmonary disease ; in others, as we shall see later, it presents itself as a predisponent to cardiac complications, to hepatic symptoms in general in the course of intestinal affections, or as a predisponent to hepatic disease.

5. Another fact which is revealed by the examination of the *table* refers to the development of the *Ga.*, which, when it is found not corresponding to the normal, coincides with nervous erethism. I say " nervous erethism " in general, but it would be much more conformable to the truth to say functional anomalies of the nervous system in those in whom this or that kind of individual feeling or idiosyncrasy declares itself more or less clearly. This note, though it has been registered in the table only in some cases for the sake of brevity, and in which the coincidence is specially clear, is and ought to be registered regularly in the clinical histories. Here it helps to recall things said for confirming greatly the importance displayed by the nervous system in determining certain morbid symptoms, as well as the value of the morphological datum.

Mutability of the Combination.

The Morphological Combination of which I am now treating does not belong exclusively to those who are predestined to succumb to pulmonary phthisis as, after having examined Table XVII., one might suspect.

This Morphological Combination, which I have deduced from innumerable observations, is precisely a general formula that includes a series of cases, some of which represent the higher extreme, others the lower, between which are the intermediate cases and variants of every kind.

In proof of this, it is sufficient to consider that individuals of the same stature can have different thoracic capacity; that individuals of the same stature and of the same thoracic capacity can differ from one another in their abdominal capacity; and that individuals who have the same skeletal height, thoracic and abdominal capacities, can differ from one another in the development of the heart, and in the different attitudes of the nervous system, considered as a whole or in its parts.

This First Combination constitutes the elements of the weak and lymphatic constitution, but with all those variations which are derived from the morphological disproportions being more or less conspicuous as regards the different parts of the organism.

Hence it occurs that this formula is, so to speak, the basis of certain special morbidities, and is predisposing to diseases at bottom lymphatic, and to those which in this lymphatic foundation find their more natural medium, as does tuberculosis. In the table I have included purposely cases of this infirmity for expressing this result of experience, for confirming a conception which the clinician cannot abandon—namely, that tuberculosis roots itself in those in whom the necessary predisposing conditions exist. A maxim much neglected since the parasitic theory or that of contagion of tuberculosis has been inaugurated—a theory which I keep before me for the purpose of scientific investigation, of biological criticism, but which I have not received with that enthusiasm shown by almost all in accepting and professing its corollaries ; and to-day in reality the repentance has begun, and they again dwell on the importance of *predisposition.* From this, when it is studied in the mode which I have proposed, will arise many criteria that will oppose not the facts, but the theories which have been founded on them for explaining the pathogenesis, for reforming the hygiene, and for prescribing cures and therapeutic programmes, with the blind faith of humanitarians, forgetful of some biological laws.

The variations which refer to this Morphological Combination are derived not only from the different proportions which the visceral cavities possess in respect to one another, but also from other factors which cannot be measured, but are reached by inspection, and concern the development of the peripheral expansion of the great circulatory system, as I have said already in another part of this book.

From the careful morphological examination of the persons appertaining to the First Combination, therefore, we shall be able not only to recognize their lymphatic constitution in general, but also to reveal in what part of the organism the morbid predisposition exists, through what organic factors some symptoms of the disease unfolded will prevail over others, or this or that complication or morbid succession will declare itself.

This First Morphological Combination is met with very frequently. It is susceptible to modifications, which depend on the play of the anatomic physiological correlations, as well as on the kind of environment in which the individual lives. But these modifications are not necessarily verified in all nor in every period of life, even admitting the same external environment, because the primitive morphological conditions are not identical in all.

The modifications which take place as a rule refer to the *heart, chest,* and *belly,* and generally occur from the twentieth to the twenty-fifth or thirtieth years, or from the thirty-fifth to the fortieth or fiftieth years.

As is natural, with the morphological transformations of the individuals the morbidities likewise change. This fact corresponds to what is known by the most ordinary experience. Very frequently in the clinical histories it is noted that at a given period of life the patients had had certain morbid tendencies, and certain others at another period. Even persons who do not require medical attention, narrating the facts of their life, state that at one time they presented susceptibilities different from those after thirty or forty years of age, or that in the course of years they had lost this weakness, or certain phenomena of weakness, which they had felt in one or in another part of the body.

I have said that the modifications which are generally met with in this *Morphological Combination* refer to the heart, chest, and belly. Now I shall deal with them in detail.

(*a*) *Modifications regarding the Heart.*

I shall not refer here to the changes which are observed in the central organ of the circulation normally during growth and the other ages of man ; I shall confine myself instead to indicating those changes which are special to the Morphological Combination, and which vary according to circumstances.

As has been said already, in the individuals belonging to this Combination the heart originally does not reach normal development. We have different cases, according to whether the heart is relatively small, or the right half prevails over the left. This fact, which I have obtained from clinical and anatomical observations, for me is undeniable.

Well, the heart, which during life may in some cases maintain itself in the same proportions in respect to the organism, in others becomes modified, and the more its modifications adjust themselves to the requirements of the body, the more it corresponds fully to the exigencies of this.

If during the whole life of the patient it fails to change itself, one observes those common cases of uniform morbidity which manifest themselves from youth to senility. For the sake of brevity we shall call this concatenation of circumstances—*Case A*.

If it adapt itself to the needs of the organism, it contributes to the improvement of this, and later is subjected in its turn to the consequences of a special acquired morbidity—*Case B*.

If it adapt itself only partially, imperfectly to the requirements of the body, this does not become transformed in the best way, and the heart undergoes another kind of final alteration—*Case C*.

Case A.—Many individuals grow and pass through all the periods of life maintaining constantly a similar corporature, the same kind of nutrition, and the same morbid susceptibilities. Whatever be the stature, they are thin, have scarce musculature, a white or brownish-white colour ; defective thoracic development ; the heart, as has been said, rather small ; the belly not proportionately large. These individuals have grown not very regularly, and may present some notes of rickets ; or the dentition was delayed irregularly ; or the cranium is deformed, voluminous, with frontal protuberances, or with those of the parietal bones very pronounced — weak, ailing in infancy, subject to manifestations, though slight, of glandular sufferings in childhood, with catarrhal affections of the respiratory or of the digestive tracts later on. They require to live with a certain amount of care ; are capable of habituating themselves to a laborious life, but always remain more or less delicate. They are rarely gourmands, frequently dyspeptics. Having reached forty years or more, they begin to suffer in a more marked way from the abdominal or chest affections. Thus they reach senility, and die from morbid conditions of the chest or of the belly, or from marasmus.

In these individuals the heart always maintains its primitive proportions in respect to the organism. According to the cases—since we must never forget that variation is the law of the living thing, and that the Morphological Combination which we are considering presents in its turn numerous variations—according to the cases, I repeat, at one or another age may be seen some sign of transformation of the body, but not such as to modify greatly its physiological capacities. Thus it may happen, and does truly happen, that some of them between twenty and thirty years show somewhat better nutrition ; that at forty or later they have acquired greater stability of well-being, and a little more resistance. And then will be verified a kind of adaptation of the organism, favoured by the nature of the occupation, or by the hygiene carefully followed. In these cases we will observe without fail some increase in the size of the heart, greater vigour of the impulse, the belly more capacious, with slight and permanent development of the liver. In others, instead, some compensatory modification in the chest takes place. In this case the appearance of the individual improves, the secretory functions in general change, and the individuals themselves become aware of this important fact when they compare the different phases of their existence.

Among all these phenomena, those appertaining to the nervous system deserve special consideration, because, being more or less resistant, more or less irritable according to the cases, they affect in a special mode the physiological and pathological phenomena of the whole body, or of some of its parts, according to what has been said elsewhere, treating of the nervous system and idiosyncrasies. And it is, above all, when we meet with individuals with an irritable nervous system that we observe interesting phenomena which not rarely require the most assiduous medical treatment. They may be spinal phenomena in a mild or severe form of neurasthenia ; or those of the stomach, or of the heart ; or those which alternately prevail in the abdomen, heart, and head.

And these nervous phenomena, though they are variously interpreted, and for a long time have been treated with different kinds of drugs, not only originate from special irritability of the nerve-centres, but are in part kept up by physiological facts, which directly represent the inadequate visceral conditions, in their turn influencing the nervous system of the patients. In reality, they make their appearance, and favour constantly the physiological work of certain organs ; and though they do not yield to medicine, they become modified, and cease with the transformation of the individual through the different ages.

Case B.—Other individuals who present this Morphological Combination become modified as they grow .About or at puberty they offer an important condition in the heart—namely, palpitation—which is felt in different degrees according to the individuals. This is a somewhat difficult age, and causes, with regard to the individual, more or less serious preoccupation. The pale face which corresponds with an oligæmic state, the irregularity of the digestive apparatus, the appearance of ephemeral fevers, the frequent bronchial catarrh, occasional epistaxis, enable us to comprehend what I would call the crisis of growth. In reality, these phenomena make their appearance while the skeleton is lengthening ; the individual becomes thin, and sometimes is obliged to take to his bed with suspicious pulmonary symptoms, attended by fever. And to give greater weight to these phenomena, active signs or more or less remote traces of distinct lymphatic manifestations may be present.

Examples of growth are not wanting with the phenomena alone of skeletal lengthening, loss of flesh, and palpitation, or with phenomena of muscular asthenia, nervous excitability, as are not wanting those of growth without notable wasting, and unattended by the subjective symptoms of palpitation.

But in all these cases, when the crisis of growth has gradually ceased (it lasts, as a rule, from one to two or three years, according to the patients), we shall be able to verify an important organic condition in hypertrophy of the left ventricle.

What does this cardiac hypertrophy, this hypertrophy of growth, represent ?

It is nothing but the effect of the physiological effort of the heart ; it is a physiological fact, seen as hypertrophy, depending upon the special morphological conditions of the individual capable of transforming himself in the way we have seen. It is, besides, a fact which may assume pathological characters in two cases : when it exceeds the limits of the anatomical correlation ; when, during the time it is being produced, owing to the special accompaniment of the phenomena of lymphatic irritability, endocarditis, pericarditis with or without inflammation of the serosa in other parts, begin to declare themselves.

Before the increase of the cardiac mass has occurred according to the requirements of the case, it happens that all the above-mentioned morbid phenomena, which, in reality, represent morbid dispositions that awaited the progressive development of the organism, gradually disappear. The fears that one had of diseases of the lung, on the general state, etc., vanish by little and little, because a kind of morphological adaptation of the individual parts is taking place, and the digestive, circulatory, nutritive, and functional capacities are becoming modified. The complex phenomenon of the physiological and anatomical correlations has occurred. The skeleton growing, the arteries elongating but not widening in proportion, first of all the obstruction to the circulation in the aortic system is increased ; then the left ventricle begins its functional work, to which follows the trophic work of the normal growth in the preparatory period of puberty. But the trophic work exceeds the ordinary degree, and thus arrives at hypertrophy.

This is connected with a type of evolution originally anomalous in the circulatory system, where the aortic tree represents what we have many times mentioned—that is, a certain degree of aplasia.

But the hypertrophy of the left ventricle succeeds in destroying the influence of this primitive fact : the endarterial pressure increasing by reason of the more energetic systole, consequently all the hydraulic relations in the other parts of the circulatory system gradually become modified, and the modifications are in proportion to the degree of primitive anomalous formation, the degree of development of the heart, and to the other morphological peculiarities offered by each individual in the different parts of the body.

In reality, that work of organic evolution or of organic adaptation is not always accompanied by the same phenomena, because the individuals in whom it is effected may present morbid conditions already established, which forbid the best success.

This phenomenon of adaptation may also create in the organism another element of morbidity, as we shall see.

Meanwhile, the individuals who appertain to this category, having reached thirty-five years or so, begin to forget their past sufferings, and recount histories which reproduce more or less faithfully those of the patients in whom one observes and can read the primitive morphological notes, and those which indicate the evolution of the organism.

In others, in whom the evolution has not been completed in the best mode, the morbid susceptibilities of the early days remain more or less accentuated.

According to whether they are favoured by a good, uniformly energetic innervation, or troubled by functional irregularities of this very important system, they represent to us different individualities still, which will be more intimately recognized, instituting the analysis of the organism, as has been said, in its place.

The organic evolution of the individuals in question does not always occur in such a way and degree as to exclude the pre-existing morbid dispositions in an absolute manner. For this reason we see some in whom a disturbance of general nutrition, by which the blood is impoverished, is sufficient to modify again the internal environment, and to reproduce the original morbid disposition in this or that part of the organism. We meet with examples of this in those persons who have succeeded in escaping the threatenings, for example, of pulmonary phthisis in youth, who then pass through years of good and reassuring health, till, owing to the intervention of physical or moral causes, capable of interrupting the harmony of the functions, of lowering the general nutrition, or of giving rise to some conditions of dyscrasia—as occurs, for instance, through pregnancy—the old sufferings are revived, with even grave and fatal manifestations.

And here it is very important to mention that when the organ again presents phenomena relative to its primitive morbidity, in the circulatory apparatus are already produced hydraulic relations corresponding to those which had been corrected. The dyscrasia, which generally consists in oligocythæmia and leucocytosis, with a greater or less degree of hydræmia, lowers the valid function of the left ventricle ; consequently the state of increased pressure in the right heart, which dilates in proportion, and in the venous tree, reappears in different degrees, and the relations between the blood and lymphatic circulations are changed conformably, and thus the primitive conditions of the cellular trophism are renewed.

Further, all the individuals appertaining to *Case B.*, in whatever period of life they fall under the observation of the physician, offer some indication of their past, either in the state of the lymphatic glands, or in some plexic and stethoscopic signs of the respiratory organs, or in diuturnal abdominal disturbances, including the uterine in females, and in all the morphological relations of the individual.

To this category of persons appertain some who offer special interest. They are, as a rule, neurotic types, who exhibit some strangeness of character, or special idiosyncrasies. In youth they overcome the difficulties of growth, not without presenting symptoms of chronic disease of the lungs, with the accompaniment of general and abdominal symptoms, frequent dyspepsia, and diarrhœa. Very soon they complain of palpitation, and with this one sometimes observes some thrills, or, more rarely, hæmoptysis. Nevertheless, the conditions gradually change ; a fairly good state of health follows. The palpitations, however, continue, and from time to time may be more troublesome, associated with some other nervous phenomenon ; there is recurrent diarrhœa, which at first is supposed to depend upon climatic influences or upon the diet, but which take place also without the concurrence of these causes ; or the patients complain of profuse perspirations, accompanied by general weakness, owing to which they become anxious, and seek the advice of their physician.

I have seen some of these patients end with the symptomatology of Basedow's disease ; and, what in this connection is even more interesting, I have seen sometimes the symptomatology of the chronic affection of the apex of the lung associated with that of Basedow's disease.

Following the succession of facts as I have studied to do, one succeeds in comprehending more clearly the genesis of certain infirmities which occur during adult age. Thus, regarding Basedow's disease, we see many elements concur together—that is to say, the primitive lymphatic constitution, the primitive disproportion of the two great circulatory systems, the consecutive cardiac irritability, with more or less hypertrophy of the left ventricle, and all the neurotic symptoms which are special to the disease. We have before us documents that invite us to reject one-sided hypotheses for explaining the pathogenesis, and counsel us to be less systematic in the diagnosis of the disease. Inasmuch as it can exist independently of the classic hypertrophy of the thyroid gland—through which the name of exophthalmic goitre seems to me to be unsuitable—it can exist also in the latent but progressive form, and succeed in generating a cachectic state. Wherefore it appears to me that this morbid condition in its different forms is better indicated by the name of *Basedow's disease,* which includes not only the slight larvated forms, but also the more severe, characteristic, and grave, both as regards the organic manifestations and the nervous and dyscratic ones.

And all these clinical forms—since they offer symptoms which may be general, or may be those of the intestinal tube, or of the respiratory apparatus, or those which are special to the disease—indicate, as I have mentioned, the participation of the whole organism, consequently a pathogenic conception more complete, which emanates from the morphological analysis of the individual.

I have said that in those in whom one sees the heart grow to a convenient degree of hypertrophy, however useful, this represents a morphological element of morbidity acquired during development. In fact, these individuals may present at a certain age also disease of the arteries, with cardiac symptoms, or without them ; in the latter case the arterial alteration is discovered on the anatomical table as an episode, to which during life attention was never directed, for the sole reason that the patient had always complained of symptoms of the respiratory apparatus.

Naturally the age in which this malady manifests itself, and the special clinical form which it assumes, depend on a concatenation of causes that vary according to the occupations, the hygienic surroundings, and the kind of life. More frequently it presents the symptomatology of the arterial affection in persons who have led a laborious life, and who suffer from nervous irritability.

Some patients, though for many years they have enjoyed excellent health, barely passed the age of maturity, either rapidly or gradually fall into a phase of interminable sufferings. Among the members of the family are those who show, either by the kind of death or by the affections in progress, that the stock from which the patient has sprung was not altogether immune from stain : there are lymphatic, scrofulous, and neurotic members. This patient, even if he romance to us about his affections of infancy—which sometimes, however, clearly and characteristically reveal themselves—presents the relics of previous lesions in the glands, lungs, or belly. His body has not the relations of development that are special to the other morphological combinations which we shall know later on. The chest, of a cylindrical or flattened form, does not measure the desired capacity ; the heart, studied morphologically, shows the play of the cardiac force effected for many years, besides the signs of fatigue, and of the dilatation which has occurred either slowly or rapidly ; and we also find all the indications of incipient arterial alteration. He complains of general weakness, inability to work or to take exercise as he was accustomed to ; he has signs of incipient capillary stasis, either marked or diffuse ; the urine is scarce ; there are inertia of the intestine and hepatic turgescence ; or cerebral, visual, or auditory disturbances.

When we come to the autopsy the picture is complete, observing the relics of old lymphatic affections ; finding atheromasia in different degrees of development ; noting hypertrophy of the heart and different degrees of dilatation ; and, according to whether the calibre of the aorta is much or little inferior to that of the pulmonary artery, the right ventricle will be more or less developed. Examining carefully the principal parts composing the heart, we find the proofs of the cardiac effort at first, and then of the incipient or advanced dystrophy of the myocardium. The columnæ carnæ are more developed where the wall has been subjected to more energetic function ; the cavitary enlargement where the stronger internal pressure was exercised.

Considering many of these cases, one can say : Give me a good anamnesis of all the past of the individual, and I shall be able to give you a conception of his morphological combination ; otherwise, give me an exact description of the latter, and I shall be able to describe to you the picture of his morbidity. This shows how important is the study of the form of the body, deciphered according to the principles of morphology that guide one to the true naturalistic study of the organism, all embracing the elements which give it individuality and special morbid attitudes.

Case C.—Here the heart adjusts itself only in part to the needs of the organism. Nevertheless, marked morbidity rarely manifests itself, though the lymphatic colour is displayed, so to speak, in all the morbid appearances that follow the action of external causes. Here it is easy to find the right heart more developed than the left. The individuals grow also with the appearance of a more abundant nutrition, and, above all, they are rich in fat, without, however, reaching the proportions which we shall see in others. While they are still children, we see how torpid the capillary circulation in the cheeks, hands, and feet is ; these parts, having a dark-red tint, are nearly always cold, perspire abundantly in the summer, and in the winter are the seat of more or less severe chilblains. Adolescence, like childhood, passes with morbid recurrences, which seem to be the effect of bad hygiene, but are not hard to combat, though they return rather often. They may also suffer from epistaxis even frequently. Youth passes almost uneventful, because the development is moderate, slowly progressive. In the majority of cases the nervous system is neither vivacious nor very resistant. Hence they do not display much activity, or those sudden efforts which, in the other individuals whom we have lately considered, are certainly one of the causes which overexcite the cardiac function. With the slight lymphatic manifestations of childhood, with the symptoms of weak muscular and nervous resistance, and moderate nutrition during youth, the individuals reach adult age, when, owing to the different responsibilities according to their social state, they are obliged rather than willing to work, and are induced by the project, not by the necessity felt, to eat in the measure which theoretically would serve to maintain or increase their strength, but which practically gives rise to a state of excessive intestinal work. This gradually affects the digestive organs and the general condition, and finally the heart, which begins to reveal its special morbidity.

These dyspeptic individuals, with abdominal symptoms appertaining to different organs which become implicated, present phenomena of plethora (as it may well be called) at every meal, and which affect, above all, the heart. The excess of introduction gives rise to, in the circulation, increase of the resistance, which the heart must subdue ; this, being unable to adapt itself to the physiological requirements by reason of its imperfect primitive morphological constitution, feels its weakness, and, after each meal and excessive corporeal fatigue, tends to become feeble. Its cavities and their musculature feel the abnormal internal pressure, and all the cardiac function becomes modified according to the resistance of the myocardium and of the nervous excitability. The plexic examination of the viscus, made at different times in the day, shows the modifications which occur in the area of dulness, according to whether it is under the fatigue of the *postprandium*, or has recovered its normal state after fasting.

These facts relative to the heart are met with in different degrees, according to the patients. Some—as we shall have occasion to show elsewhere—are larger eaters than others, but are so constituted that the absorbent venous system, considered as a whole, represents a section of vessel greater than that which may be called the disposable part of the arterial system. Well, the more these morphological conditions prevail, the more the cause of the cardiac symptoms increases.

These, after having for a variable time remained mild and of short duration, become more constant, more severe, till later on they may constitute the clinical form, more or less grave, of dilatation of the heart, with degeneration and atrophy of the myocardium.

Inasmuch as in this category of individuals the conditions relative to the heart ordinarily take place with those of other parts of the organism, we must defer their further consideration till we speak of the other changes by which the body is transformed.

(*b*) *Changes Regarding the Thorax.*

Army medical officers can testify whether, and to what extent, this part of the body is capable of modifying itself during the final phases of growth. If one were able to obtain all the facts which relate to this question, one would have material for an important chapter of physio-pathology. Statistics alone serve only partially to the scientific scope, for they do not go beyond the empirical demonstration of the fact which we are now considering.

It would be necessary, instead, to know all the modifications that follow those which have occurred in the thoracic capacity, to see what happens in the heart, how the general circulation and the functions of other organs are modified. It is to be hoped that the army medical institutions will correspond in the future to the scientific aspirations of the many clever young surgeons who up to now have exhausted themselves in the barren struggle against rigorous but not always wise regulations.

The modifications which take place in the chest may be met with from sixteen to twenty or twenty-two years of age. They refer, as a rule, to the capacity, less frequently to the form.

From my observations, I can say that the thorax may become larger, and the heart develop proportionately or not. Thus, we have two different cases: *A*., Combined modification of the chest and heart; *B*., modification of the chest alone.

Case A.—This occurs in individuals in whom the modification we are studying no longer consists in the smallness of the thorax and of the heart in respect to the skeletal height. They are persons who, though they possess the morphological attributes which we know, present also in childhood a certain robustness and a certain development of the musculature. The expressions of the lymphatic constitution are not wanting sooner or later, and the general development is not regular, and even sometimes seems to be arrested. Nevertheless, they leave a sufficient amount of tranquillity as to their future. These are the individuals in whom the gymnastic treatment has given very satisfactory results, because from it is gradually obtained an increase of the functional capacity of the parts of the organism which are in question.

In this connection I believe I can maintain that, although preventive gymnastics may be prescribed indiscriminately to the individuals who appertain to the First Morphological Combination, one must consider an error, not without consequences, that which nowadays is observed in gymnasiums and ordinary schools of gymnastics, where, with little discernment, they give the same exercises for the same length of time to individuals who have different corporeal attitudes, different gymnastic capacities, and different requirements.

We see it every day by experience. Some individuals object altogether to gymnastics, which they dread and do not believe in, because it is imposed on them in a measure which is beyond their strength. Others have been even permanently injured by them, so that the former and the latter give up these physical exercises, which, if they had been more judiciously prescribed, would have undoubtedly improved their lot. This is so true that it is necessary to know the individualities in every practice, whether it be hygienic, physiological, or clinical, properly called.

I have mentioned that the individuals belonging to *Case A* are the best conditioned for transforming themselves, and, in reality, they sometimes present phenomena which even make one doubt the diagnosis and prognosis expressed before their transformation. Those of them in whom the heart alone is modified acquire a better blood-crasis, and the whole organism assumes the appearance of robustness. If in those in whom the heart alone enlarges some cardiac phenomenon presents itself among the other manifestations of the special morbidity, in these, on the contrary, one observes the circulation better equilibrated, and if other conditions caused by bad hygiene do not intervene, the organism may pass through many years in safety, without even a single sign of cardiac hypertrophy declaring itself.

It is sufficient to remember the importance of the respiratory act, not only as regards the chemical fact, but also for the influence that it exercises on the circulation in general, and directly on the heart, to convince ourselves of the favourable consequences which will be derived from a good evolution of the chest, and from the beneficial influence of respiratory gymnastics—in fact, they modify the primitive Combination.

It is necessary to have followed with scrupulous observation this kind of natural facts, not to fall into—as easily occurs—systematic views. Indeed, the modifications in the individual morbidity do not always correspond to the morphological changes of the thorax and heart determined spontaneously, or by art improperly used, because they do not invariably correspond to a correct plan of anatomical correlation. In the same way cases are not wanting in which, notwithstanding these beneficial changes, the morbid phenomena that appertain to the primitive structure of the body present themselves.

Just as it would be extending too much the value of the things above described, pretending that, the morphological relations of the organism having improved, the indications of its primitive morbidity would never again make their appearance, so also it would be denying too much should one declare, in the presence of the possible exceptions mentioned, the facts studied by me doctrinaire and impossible.

These exist, and when exceptions are met with it means that we must study something further ; it means that either the individual conceals some condition which must be investigated before coming to a conclusion, or that the science has not succeeded in explaining the reason of all the events of practice. *Variante causa variatur effectus* and *vice versâ.* Following this principle of scientific determinism, even the exceptions will be explained.[1]

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[1] Having introduced into our researches the conception of variation as the law of living things, one should speak not of *exceptions*, but of *variations* in the morphological combination. Here, moreover, it is the exception that proves the rule, which in our case is constantly confirmed, showing how the different morbidities are always connected with different morphology of the tissues, organs, systems, and organisms.

Meanwhile, from now onwards some can be understood. If those individuals who have escaped the changes of young age, and have for a variable time enjoyed excellent health, later on suffer from some infirmity which the most severe criticism must recognize as proceeding more from constitutional causes than from external ones, it means that the exercise of the functions in the intensity of the primitive morbidity has been able to revive itself. For example, some of them at adult age, when glandular affections do not usually present themselves, may show in the neck or some other part enlargement and suppuration of the glands ; or others will have a skin disease more or less extensive, which is special to the lymphatic constitution. One may meet with in others a monarthritis, which gradually declares itself with symptoms of articular tuberculosis ; or there may be other forms of chronic hydrarthrosis, especially of the knees, as for long years one sees in patients who, though in other respects they pass for healthy, become known by the history of the morphological conditions carefully studied and by their special morbidity. And it is precisely in these individuals that all the affections, both inflammatory and infective, assume special characters : the former give rise to abundant exudates slow in disappearing ; the latter are accompanied by visceral complications which vary according to the part where the predisposing morphological note is most marked ; or they have morbid successions which do not occur in patients better constituted.

Case B.—When the chest alone is transformed, though the general conditions of morbidity may improve, this does not permit of, as in the preceding case, the organism becoming robust. The intervention of external causes is not necessary for arousing the tendency of the organism to certain morbid manifestations, but these almost incessantly declare themselves, though mitigated and compatible with a certain appearance of health.

(c) *Changes Regarding the Abdomen.*

A fact of common experience gives an idea sufficiently clear of the transformations which may occur in the abdomen. It is known to all that some individuals who up to a certain age are thin and slender gradually begin to increase in the abdomen, and sometimes this occurs so slowly that it may almost escape recognition.

This fact is fairly frequent in the individuals who belong to the Morphological Combination which we are studying.

If we make inquiries as to their past and present morbid vicissitudes, they tell us of their sufferings, which are all more or less referable to the lymphatic constitution: glandular and conjunctival affections in infancy or in childhood; catarrh of the respiratory or digestive apparatus; acne scattered in the skin, *pityriasis versicolor*, leucorrhœa; chronic granular pharyngitis, discharge from the ears—in fine, all that which is directly derived from the special lymphatic constitution. With regard, then, to the pulmonary phenomena, one may mention the grave fears conceived on the state of the lungs, the hæmoptysis, feverishness, and so on.

And all this is gradually modified in such a way that the morbidities, manifested first in the respiratory apparatus, diminish; the symptoms which threatened phthisis become mitigated; finally, the general nutrition awakens, the appetite increases, and after a variable time the abdominal phenomena begin to declare themselves.

This is, as I have often said, in brief, what in many cases is observed, and which is sanctioned by clinical experience. These facts give rise to the opinion of the laity that frequently opposes the blind hope in better events, supported by cases which experience has presented, and to the just reserve of the physician, which they will not understand. On these facts researches have been instituted also by able physicians who occupy themselves with the natural treatment of pulmonary phthisis (Boudet).

This change of things takes place gradually, thanks to the laws of adaptation of the individual parts of the organism.

We have seen what happens as regards the heart and the thorax. Here we must describe all this, for that which is being prepared in the abdomen is favoured by the changed conditions, especially the circulatory ones.

While, therefore, on the one hand the heart becomes modified in the one or the other mode which we know and the chest reaches its greater development, its inferior part, that destined to form the wall of the hypochondria, becomes enlarged by degrees, and the superior segment of the belly expands.

This is, as we have seen, a morphological character which indicates the development of the liver, or, speaking in a general way, of the organs which are found in the superior segment of the abdomen.

If, besides this, as is frequently met with in the Morphological Combination in question, the line *Xu* is very pronounced, we have united two morphological characters which refer to the above-mentioned condition of development of the abdominal organs.

Consequently we can say that in this First Morphological Combination, the line *Xu* originally may have presented different degrees of development superior to the normal from a minimum to a maximum, and that when, owing to the final evolution of the organism, the base of the thorax enlarges, the morphological value of the line *Xu* increases in proportion to this enlargement.

In this formula is included the infinite variety of the cases met with in practice. Among these are included many of those in which we see the organism transformed, especially by the modifications of the heart and thorax, the abdomen also being modified in them; but we must now mainly occupy ourselves with those in which, during the transformation of the organism, the modification of the belly is rendered specially notable.

In these, as we have stated, we see the morbidity of the chest gradually substituted by that of the belly. In fact, while the physiological and pathological phenomena of the respiratory apparatus become corrected and the nutrition improves, others make their appearance which precede morbid states of the abdomen.

The appetite increases and the individuals not rarely become gourmands or even drinkers. The nervous system shares in making them one or the other, and also influences the complex of the nascent symptomatology in such a way as to give it a special tint, as we shall see.

The gastric and intestinal dyspeptic forms arise gradually in them. They suffer spontaneously, or, after some dietetic abuse, from hepatic disturbance, sense of weight, tension, and even recurrent pains in the hepatic region. The urine is abundant—that is, it reaches its physiological maximum—or it may be scarce, and then one frequently observes a deposit of urates, and the indican is copious. And they are not rarely troubled with piles.

During this state of things—which generally is considered, not in its pathogenesis, but only in its clinical expression, and is said to be intestinal catarrh, which may also be present or have existed before the new facts—other manifestations in the skin may declare themselves: eczema, limited to the scrotum, to the perineum, or to the folds of the thighs, or it may extend itself to other parts of the body; these catarrhal conditions, though of short duration, appear in the mucosæ of the eyelids, fauces or large bronchi, always attributed to rheumatic cause alone, while this would not have acted if there had not existed in the patients the predisposition in the special morphological constitution—commonly called lymphatic—of the tissues. Sometimes these individuals perspire readily, and the skin is more unctuous than in others; and if they be endowed with exquisite general sensibility at every diminution of the cutaneous function, they feel systematic exacerbations in the internal organs. Some of them may suffer frequently from diarrhœa, and the bowels act twice a day normally, almost as a phenomenon necessary for maintaining a certain state of abdominal equilibrium; others, instead, suffer from constipation.

These individuals are often subject to rachialgia and lumbago, which are connected with torpor of the circulation in the prevertebral veins, as is shown by the therapeutic experiment—that is, the use of purgatives and the application of a leech to the anus; or they complain of unpleasant sensations in the hepatic or splenic region, or in the precordia, or along the course of the colon.

Among these phenomena, in some one will see a certain degree of varicosity of the legs gradually make its appearance, and even before this varicocele may have been produced. At the same time the condition, more or less severe, of internal and external hæmorrhoids may present itself.

The kind of life led by the individual naturally influences this condition of things either favourably or unfavourably. In this connection may be mentioned all the errors and excesses of the table.

This is a very important question, which would merit long discussion, because it would show that the errors of diet are not only those which are commonly acknowledged by the laity, and are included among the casual events of life, but also those which are daily committed by those who eat according to their special tastes, and, ignoring the limited tolerance of the digestive organs, satisfy daily their appetites, which gradually become habits, and so long as the resistance of the organism holds out, they ingenuously believe that they satisfy hygiene, keeping religiously to the habits formed. But later on unexpected consequences present themselves.

The digestive apparatus, compared with all the other apparatus, has great powers of adaptation ; consequently it is easy to find individuals who become gourmands by intention, exaggerating the amount of reconstituent food prescribed, and then by habit. They become, one might say, specialists of the table, because, besides being capable of getting rid of enormous quantities of food, they also prefer one kind to another.

Notwithstanding this great tolerance of our organs, the most grave disorders insensibly arise. The excessive work of the digestive organs is the cause of very active and durable functional hepatic hyperæmia, of excessive absorption, that gives rise to true plethora, which is daily repeated, determines excessive work of the cardio-vascular and renal organs, and, in general, of all the secretory organs, and which, according to the individuals, favours the production of fat in the parts where this is usually deposited. It also gives rise to a series of nervous phenomena which accompany the different stages of the digestive function, through which the repleted stomach is either the cause of vasomotor phenomena in the head, or the excessive distension of the intestines gives rise to different troublesome sensations, which are the beginning of nervous alterations that may become more intense, more extensive and persistent, till they constitute the characteristic picture of hypochondria.

All these conditions are not met with in the same form in every individual : in some the cardio-vascular phenomena prevail ; in others the hepatic, according to the special morphological conditions and the particular mode of production of the dietetic disorder.

In the cases which we are considering, in reality, though the individual may up to a certain age present the appearance of excellent health, in the majority of cases the moment arrives in which, either slowly or rapidly, the morbid conditions, for a long time preparing themselves, are announced.

In those individuals in whom the cardiac phenomena take place one observes, after a certain period of functional alterations, increase of the cardiac area, with dilatation of the heart prevailing, but with very pronounced hepatic symptoms ; and in this is declared the special morphology of the patient, for in the individuals whom we have studied in the preceding paragraphs this does not occur. The condition is as follows : The liver, which is developed more than in others, and considered as a vascular province, is disproportionate in respect to the centre into which it pours its blood; directly the heart lowers its functional capacity, the liver exhibits hydraulic effects in an exaggerated degree. This one comprehends only on consideration of the fact that it alone shows in that way the defective cardiac action, while all the other parts of the organism gradually manifest phenomena of stasis. The cardiac alterations proceeding, the hydraulic effects will also extend ; but this special disproportion of the hepatic enlargement always remains.

This condition is met with only in those who appertain to the Morphological Combination we are examining.

In the individuals in whom the hepatic phenomena occupy the most important part of the symptomatology, after the dyspepsia has lasted for some time, the hepatic suffering makes its appearance. This in some cases is almost awaited, owing to the existence previously of certain manifestations relating to the liver, such as a feeling of discomfort and weight in the right hypochondrium ; and jaundice due to duodenal catarrh may also have been observed ; or the patient may have presented a special tint, which all agree in calling expressly hepatic.

The alterations which later on present themselves may be those of recurrent hyperæmia of the organs, corresponding with the intestinal lesions which are very frequently induced by constipation ; or those of hepatic hyperæmia, with painful and febrile symptoms ; or they may be those of intestinal colic, or hepatic colic, or interstitial hepatitis.

Together with these various morbid manifestations, strictly hepatic, there are others secondary, but which in their turn express the different morphology of the abdomen, with their clinical varieties, and are : hæmorrhoidal phenomena ; renal alterations ; hæmorrhage in one or other portion of the intestinal tube or in the bladder ; œdema of the legs and of the trunk, extended to the dominion of the inferior vena cava (see the chapter, Patologia della vena cava ascendente, in vol. i. of "Commentari," already cited).

Finally, the individuals in whom the changes of the belly are determined, with increase of the phenomena of the nervous system, show, as a rule, that the evolution of the belly has not reached a very pronounced degree. Therefore, although in general the sufferings indicate a certain inclination to symptoms of hepatic hyperæmia, hypercholia, torpor of the abdominal circulation, piles, etc., the neurotic note prevails ; hence the reason of the visceral neuralgia and the hypochondriac forms.

But to understand both the above-mentioned facts concerning the morbidity, we shall now see more definitely what the modifications are which occur in the abdominal cavity.

We must verify, in fact, the play of the functional correlations in the last phase of the individual development.

When we examine one of the patients appertaining to the First Morphological Combination about to be relieved of his morbid difficulties, especially caused by the morbidity of the respiratory apparatus and of the lymphatic system, first of all we observe an improvement in the blood-crasis.

This is a fact of the highest importance. It is attributed, as a rule, to the reconstituent treatment and to the continuous doses of iron, and it cannot be denied that these means sometimes have their importance. But the question which I have to consider is different, as is shown naturally by the facts.

Indeed, having verified that the treatment, *cœteris paribus*, does not always respond in the same way, and that where it responds and seems almost to perform miracles—to use a very common expression—the miraculous effects manifest themselves together with phenomena of evolution of the organism, without which the treatment would have given less satisfactory results, or even none.

Further, every physician knows individuals who, owing to their eccentricity or otherwise, have given up the most promising and reputed treatment, to adopt instead a mode of life suggested more by special individual instinct than by experience ; and the more pleasing events give rise to a state of almost enviable health. But this occurs because the individual has been transformed.

When this transformation takes place late, the condition of disease or of simple morbidity of the patient continues unchanged ; he, in spite of the various kinds of treatment carefully and assiduously carried out, ends in making a kind of experiment on himself much more convincing than that followed by the physician according to therapeutic teaching. The latter would continue more or less confident to try new kinds of treatment, while the patient makes use of this remedy or that which mitigates some disturbance, and follows one or another hygienic precept from which he has received some benefit ; but he does not follow the treatment prescribed, and, if he be an intelligent observer, practises the *quo natura pergit* with rare discernment. In fine, both doctors and patients will confirm later on what I have said above —namely, that when the organic conditions are modified one can hope for the true cure.

It is therefore important to form an exact, or at least approximate, conception of the nature of things, because this expression generally employed is equally interpreted by all.

I have said that when the blood-crasis begins to improve, the signs of amendment in the morbidity of the respiratory apparatus and of all the lymphatic system also begin, and that this amendment, whether it be assisted or not by the treatment, must be attributed to another cause—that is, the morphological one.

The improvement in the blood-crasis indicates the moment in which the new phase of evolution in the abdominal organs commences : the appetite increases, the digestion improves, and the heart becomes stronger. The function of the liver, which is one of the most important functions regarding organic exchange, is corrected, and all the important secretions, especially the urine, change.

The liver enlarges, the intestine increases, and in its final development follows the natural law of adaptation, which it undergoes in a very large measure, and hence becomes modified in relation to the quantity and quality of the food consumed.

But in saying that the liver enlarges, it is necessary to admit that the enlargement is due, not to simple hyperæmia, but to a true evolution, an increase of the hepatic tissue, so that this organ, which previously could receive only a certain amount of blood, gradually receives greater amounts.

This phenomenon is pre-established by the special primitive individual organization ; if not it would happen in all, and not only in some. But besides being pre-established, it is likewise favoured, and even exaggerated, by the increased introduction of food, and by the digestion, through which periodically happens (the circulatory system being abnormal in the sense that there is primitive hypertrophy of the arterial system and relative excessive development of the venous system, and, above all, of some parts), a true condition of abdominal plethora, which dissipates itself especially in the liver, but besides this, owing to the above-mentioned conditions of primitive development of the circulatory system, meets with some difficulties of movement, greater or less, according as the modifications permit which gradually take place in the heart and thorax.

To this is due the increased internal pressure in the portal system, which facilitates the turgescence of the prevailing abdominal venous system, and successively in the hæmorrhoidal, determining consequently the above-mentioned expressions of morbidity ; to this are also due the almost habitual state of hepatic repletion and an abnormal degree of internal pressure in the inferior vena cava, which is stimulated to greater activity to support the blood-mass and favour the reflux circulation.

So long as the age of the patient, the resistance of the tissues, and the hygienic circumstances favour this equilibrium of things, all proceeds with the appearance of health, though, as we have mentioned, the phenomena are not wanting which reveal the special morbid dispositions that are organizing themselves.

But when the dietetic error is continued, or when the slight organic resistance and the mode of life do not correspond to the morphological requirements, they gradually give rise to morbid phenomena, which, in the order with which they present themselves, in the intensity of their appearance, in the eventual complications by which they are followed, reflect not only the causes encountered, but also the pre-established morphological conditions. The different dyspeptic and catarrhal intestinal forms are followed by hæmorrhoidal swellings ; later these are associated with phenomena either prevailingly hepatic or prevailingly cardiac, according to the primitive dispositions. Later still the hæmorrhoidal conditions become more pronounced, and their consequences may be either direct or indirect. The former develop in the dominion of the intestinal circulation, the latter in the centres of central innervation, the central vein of the medulla spinalis being in relation with the prevertebral veins, which empty themselves into the hæmorrhoidal circulation ; hence certain manifestations of lumbago and other forms of altered sensation and motion, which in these patients are frequently observed. Later still, the hepatic enlargement continuing, and the preceding symptoms becoming aggravated, one may verify the diminution of the urinary secretion with the presence of an excess of urates ; hence the coincidence of well-being with an abundant amount of urine, and *vice versa*. Finally, matters progressing, we may meet with complex morbid states, in which one sees cardiac, arterial, hepatic, renal, vesical, uterine symptoms associated with one another in different degrees, according to how the phenomena of organic evolution are progressing, according to the causes which have acted, according, lastly, to the different influences exercised on the nervous system.

I have said that in the inferior vena cava may be felt an abnormal degree of internal pressure, and consequently a functional condition of its walls corresponding to the increasing physiological requirement. Now I must add a few remarks concerning the inferior vena cava.

As results from my observations, it presents an anatomical structure and a function which vary according to the individual : it offers not only a different capacity, but also a different contractile activity and a different resistance.

Therefore it happens that when the need of its activity begins to become greater, as I have mentioned already, this may be permanently, or for only a short time, proportionate to the need. And in the individuals in question we have indications for one or the other circumstance, which refer to the anatomico-physiological conditions of the case we are considering.

In those in whom the action of the inferior vena cava is insufficient, first of all the circulatory difficulties in the hepatic veins become increased, with the consequences that all foresee in the hepatic gland. In the second place, its insufficient activity is felt in the reflux circulation of the emulgent veins, which reveals to us one of the reasons, when we meet with pathological conditions analogous to those above described, through which the scarcity of urine frequently occurs. In the third place, one comprehends how, during these morbid conditions, œdema of the legs, more or less pronounced, may take place readily, and which sometimes invades the dominion of the inferior vena cava (as I have shown in articles on the " Pathology of the Vena Cava Inferior "), and may be considered as a true complication, because it indicates a morbid state of this vessel (inflammation, hyperæmia, dilatation). Finally, when the increased work of the inferior vena cava begins to be required, and it happens that this work is not proportionate to the needs, we have an indication of it in the appearance or in the exaggeration of venous dilatation of the legs.

Appearance or exaggeration, I say, because even here one must remember—as I have said when speaking of Inspection—that the peripheral venous system, as regards its development, presents variations according to the individuals, in such a way that in some the varices of the legs, or of one leg only, may have appeared before those morphological and physiological changes of the cava to which we have up till now referred had taken place.

To sum up : The changes that occur in the belly, owing to which a modification of the First Morphological Combination is possible, concern the liver, intestine, kidneys, and large vessels. The liver enlarges ; the intestine becomes more capacious ; the kidneys are less constantly modified ; the large vessels (vena portæ and inferior vena cava) undergo different changes. The former becomes more capacious according to the amount of venous absorption, which is proportionate to the quantity of food, and to the greater expansion of its capillary origins ; the latter, being stimulated to a more energetic function, may, according to its primitive structure, become hypertrophied, dilated, or, in certain circumstances, altered by the slow process of altered nutrition (endomesoperiphlebitis).

These morphological changes take place very gradually, and are accompanied by a modification in the individual morbidity, and by changes which may equally occur in the heart and thorax.

The individual transformation which by this means we observe presents so many forms that they are understood better by examining each individual, as there may be in every case some variations. Nevertheless, we can divide them into groups, according to the more frequent combinations : First group, with predomination of cardio-vascular morbidity ; second group, with predomination of abdominal morbidity ; third group, with predomination of defective visceral innervation ; fourth group, with different morbidities little accentuated, without the predomination of any.

III. Second Morphological Combination.

In this Morphological Combination we shall see the development of the chest prevail, and shall find a proportionate development of the heart and of the arterial circulatory system. This is the fundamental note ; further, in the other parts we shall find dimensions more or less adequate and proportionate, according to the cases.

S. $<$ or $=$ Ga.
Thc. $> \frac{1}{2}$ S.
Stl. $< \frac{1}{5}$ Thc. or $= \frac{1}{5}$ Thc
Abl. $=$ or $> \frac{2}{5}$ Thc.
Bi-il. $=$ or $>$ or $< \frac{4}{5}$ Ab.
Heart $>$ normal, or $=$ normal

This Combination is exclusive, I would say, to the young, and more still to the adult, inasmuch as I have never met with it in infants, and in children I have only rarely seen proportions which resemble it, but have not reproduced it.

This fact is important, for, since the First Combination can be considered special to infancy, thus the cause of its special morbidity is indicated in the imperfect evolution of the organism, or, better, of some of its parts ; while the morbidity of the Combination which I am about to explain depends especially on the excess of evolution of some parts.

Although I cannot say that in this Combination are found the more robust and stronger constitutions—to use the customary expression—yet the morbidity is less. The diseases of the circulatory apparatus predominate over the others, which may arise either owing to accidental causes or to variations in the morphological conditions of some organs that associate themselves with others to which one must ascribe the special morbidity of the Combination.

We shall now deal with its structure.

In this Combination also the great aperture prevails over the stature, and more or less marked nervous excitability is noted. We must take this likewise into consideration, because it is one of the chief physiological coefficients through which that excessive function which the organisms in question are prone to usually manifests itself, and which is constantly accompanied with phenomena of orgasm in the activity of the vascular organs.

The thorax exceeds the half of the corporeal height. This may be an excellent attribute, physiologically speaking, but this does not prevent its having a special signification of morbidity.

As a rule, the big chest contains a circulatory centre in which exist morphological conditions diametrically opposite to those which we have considered in the First Combination. In fact, we find the heart well developed, and the aortic system correspondingly well developed. Hence the state of the general circulation differs greatly from that of the individuals appertaining to the First Combination. The skin has a rosy tint, the true flesh-colour ; to this corresponds the nutrition of the soft parts which are firm. Muscles, skin, and panniculus adiposus are in excellent proportions. The skin is soft and not excessively unctuous, is not traversed by venous networks, nor made coarse by acne. The pulse is strong, and the muscles are ready and resistant. The expression of the face is vivacious, and the cerebral and spinal functions are active. The wave that the arteries everywhere transmit into the capillaries is full and equal.

The big chest provides oxygen in plenty ; the metabolism takes place rapidly, and the desire for food in these individuals is accompanied by a good appetite ; the digestion is excellent, and the intestinal function is performed regularly ; the greater secretions of the body are normal in quantity and proportionate to the intake, so that one never meets with phenomena of visceral circulatory stasis, and the consequent retention in the body of the substances which give rise to dyscrasia, that, even when of short duration, is the cause of many morbid symptoms, of which this is not the place to speak.

Here the aortic system relatively prevails over the other parts of the great circulatory system ; and, considering the coincidence which is met with of this anatomical condition with the relatively greater size of the chest, one can infer from it that both facts are the necessary result of the functional correlation which obtains between the abundant arterial circulation and the nutrition of the respiratory organ.

We have seen examples of the big chest also in the First Morphological Combination, but if one reflects for a moment on the different anatomical condition of the parts, one will understand the remarkable difference which exists between the two types of big chest. In the former there is excess of development of the vessels that come from the ramifications of the pulmonary artery ;

the chest is flattened from before backwards, and the thoracic muscles are relatively poorly developed. In the latter, on the contrary, the arterial system is prevalent, the form of the thorax is roundish, the musculature robust, and the sagittal diameter proportionate to the other thoracic diameters. In the former we have a venous circulation in search of oxygen obstructed by two conditions little favourable to the respiratory function—the circulatory difficulty and the weakness of the respiratory muscles; and, finally, a morbidity which we know, and of which we have not an example in the Combination we are now studying.

We can truly say, therefore, that these facts have physiological and pathological importance: they explain both what has been gathered by ordinary experience, and what is revealed daily by clinical observation.

He who believes that individuals with a big chest are immune from certain diseases will subsequently find himself deluded, when in the presence of the morbid conditions he is obliged to conclude that, notwithstanding the thoracic capacity, it is necessary to admit a pathological condition from which it appeared to him the patient would be spared: chronic catarrh of the respiratory passages first, then the secondary lesions of this, broncho-alveolitis, and tuberculosis finally, come to destroy the best anticipations.

This shows that we must not be contented with the general notion of the apparent thoracic capacity. It is necessary to analyze it and to see its intimate structure—that ensemble of organization from which is derived what one may call the suitable environment or not for the predisposition to certain diseases. And this must be considered the more necessary to know nowadays: that the etiology of certain diseases—that of tuberculosis especially—cannot be thoroughly understood if the two indispensable elements—the infection and the disposition, the bacillus and the environment—do not harmonize. If the study of the environment and that of the appearance of the tubercle bacillus in the organism do not proceed together, one cannot comprehend in its entirety the pathogenesis of the morbid process. Attributing all the importance to the bacillus is an error; recognizing only by name the morbid disposition, and not making a special study of it, is an absurdity—a defect which leads to other errors. Giving oneself to the study of morbid disposition without the guide of morphology would be tantamount to neglecting the fundamental postulates of the science. What does this disposition consist in ? This is the thesis ; this is a task which up to now has been neglected by those who have interested themselves exclusively with the biology of the bacillus studied outside the human organism in guinea-pigs, without thinking that one cannot admit, until it has been demonstrated first, that the medium of guinea-pigs is equal to that of man, that the tuberculosis of guinea-pigs is equal to that of man. By reason of the teachings of comparative anatomy and physiology I doubt this very strongly.

In Table XVII., dealing with the First Morphological Combination, I have included an example of a man who, in spite of the physical symptoms of tuberculosis, was not tuberculous, as was shown by the passage of the echinococcus through the large bronchi. Here I wish to record another case which at first impressed me, because I myself fell into the diagnostic and prognostic error which I am discussing. I summarize it briefly as follows :

S. ..		.. 168 ..	..	..	Discrete organic resistance ; marks of lymphatism in infancy ; habitual catarrh of respiratory tract ; weak digestive function ; broncho-alveolitis, and pulmonary phthisis at thirty-eight years.
Ga. ..		.. 174 ..	Excess of C.	8·0	
Thc ..		.. 90 ..	,, ,,	6·0	
Stl. ..		.. 16·2 ..	Defect ,,	0·6	
Abl. 33	*Xu.*	19 ..	Excess ,,	2·2	
	..	..	Defect ,,	0·6	
	Up.	14 ..	,, ,,	2·8	
Bi-il ..		.. 24 ..	,, ,,	2·8	
Heart small		..	..	..	

Owing to the excess of the periphery of the thorax in this case, it seemed that one ought to have been content. But when one considers not only the form of the chest, which was flattened, but also the development of the heart, which was small, and that of the abdomen, which was insufficient, they fully justify the events, because, remembering what has been said on the anatomical correlation that exists between the heart and the rest of the circulatory system, between the development of the belly and the general nutrition, one must form an opposite opinion to that which was conceived at the first glance of the thorax. Nor was the heart by itself sufficient to modify the hydraulic relations in the respiratory organ ; nor did the digestive process correspond to the needs of the organism. Consequently the nutrition was not, either in intensity or quality, capable of guaranteeing the best repair, the greatest organic resistance.

One understands, therefore, the necessity of thoroughly establishing the conditions of the intimate anatomical constitution of the chest, before coming to a conclusion on the sole datum of the external measurement, even if it be supported by the spirometry. One must suspect that it does not correspond to the full physiological requirements, when, in spite of its bulk, it is flattened from before backwards, is provided with weak muscles, and the *normal* thoracic excursions are not extensive. And one will conclude that it does not in reality secure the individual against the appearance of the diseases which we have seen are common in the First Morphological Combination, when the heart is small in proportion to the other parts of the body.

Having said this, we shall now deal with the special morbidity of the Second Morphological Combination.

In the individuals appertaining to this Morphological Combination, we are struck by the fact of the predomination of affections of the heart. They are generally of robust type, and yet their morbidity is in the centre of the circulation.

Therefore in all we find an equal morphological character and equal morbidity. The former consists in the predomination of the thorax and in that of the heart considered in its left ventricle; the latter manifests itself in the quality of the symptoms of the acute diseases in general—usually accompanied by vascular orgasm and arterial hyperæmia—and in the frequency of affections of the circulatory apparatus.

The importance of the observations which we summarize in the following table consists in the fact that they have to do with individuals who were examined before the onset of the disease and after it had manifested itself. They are patients who consulted me accidentally for slight disorders, and of whom I took notes for the purpose of study, and whom later on I saw with symptoms of different cardiopathies. I could have included other cases, but of all I have not had the opportunity of obtaining the necessary information with the desired exactness, especially as regards the measurement. Besides, in another table I will give other facts to confirm these.

Having examined this table and noted the fundamental fact regarding the excess of development of the chest and of the heart, besides the disease of the circulatory centre, one thinks immedi-

TABLE XVIII.

EXAMPLES REFERRING TO THE SECOND MORPHOLOGICAL COMBINATION.

	Morphological Combination.	Pathological Conditions.
1. SHOPKEEPER ..	S. .. .. 168 Ga. .. .. 174 Thc. .. .. 88 Stl. .. .. 17·5 Abl. 33 { *Xu.* 18 { *Up.* 15 Bi-il. .. .. 23 Heart > than nor.	Seen June 15, 1880, for gastric catarrh following dietetic disorders at thirty years of age. Life very active, great resistance to bodily fatigue. Nutrition excellent; musculature of body rich; pulsation in arteries vigorous and resistant. Individual excitable, fiery. Seen January 10, 1884. Presented increase of cardiac dulness, especially in left ventricle. No cardiac murmurs, but palpitation; painful sensations in præcordia, great arterial circulatory excitation. April 15, same year, the *symptomatology of aortic stenosis* had formed. Has never had rheumatic affections.
2. LAWYER.. ..	S. .. .. 170 Ga. .. .. 180 Thc. .. .. 90 Stl. .. .. 18 Abl. 30 { *Xu.* 16 { *Up.* 14 Bi-il. .. .. 24 Heart > than nor.	Seen January 12, 1881, for nervous suffering (hemicrania and dyspepsia). Laborious life; nervous exhaustion. Frequent circulatory disturbances, with feeling of pulsation in all the arteries and heart during and after physical and mental work. Aged thirty-eight years. July 7, 1883: Palpitation. March 16, 1884: Pleuropneumonia, with blood-stained sputum. April 14, 1885: Characteristic phenomena of auscultation and percussion relative to *insufficiency of the aortic valves and incipient stenosis of aortic orifice.* The fact was important that each time there was circulatory disturbance, owing to fatigue of the heart, the liver became enormously swollen. No signs of œdema of the legs.
3. ADMINISTRATOR..	S. .. .. 164 Ga. .. .. 164 Thc. .. .. 88 Stl. .. .. 16·5 Abl. 32·5 { *Xu.* 17·5 { *Up.* 15 Bi-il. .. .. 20 Heart > than nor.	Seen October 8, 1877, for intermittent fever. Thirty-six years of age. March 14, 1878, suffered from severe lumbago, owing to overwork. September 15, same year, suffered from palpitation, which subsequently came on after overwork or some intemperance. September, 1880: Cardiac hypertrophy, pains in chest and left arm; some irregularity of cardiac function. September, 1881: *Aortic insufficiency; sterno-cardiac attacks.*
4. MERCHANT ..	S. .. .. 166 Ga. .. .. 170 Thc. .. .. 85 Stl. .. .. 17 Abl. 33·5 { *Xu.* 17 { *Up.* 16·5 Bi-il. .. .. 21 Heart > than nor.	Seen August, 1882, for phenomena of neurasthenia and slight disorders of stomach. Age thirty-eight years. Sexual abuses. Previous health perfect; a few years of military career; has never had syphilis nor rheumatic affections. July 20, 1888: Healthy aspect, but resistance to active life diminished owing to the sudden appearance of difficult respiration and palpitation, with the sensation of pulsations in all the body. Requires absolute rest after meals, even when these are small and chosen. For years has given up sexual abuse. Cardiac dulness increased; impulse of apex strong and a little lowered; the pulsations of the carotid, temporal, radial, and dorsalis pedis arteries abnormally visible. Pulse 80, regular. Sounds at apex normal, at base on aorta, second sharp, sometimes bipartite. *Hypertrophy of left ventricle; incipient central atheroma.*

ately of the different pathogenesis that in this case the cardiac phenomena have in respect to that which we see could have happened in the individuals appertaining to the First Morphological Combination.

In reality, in this Second Combination we see before the beginning of the disease a state of health for the most part perfect, or pathological conditions caused by excess of function or by accidental circumstances ; while in the First Combination there are morbid antecedents in which the cardiac effort displays itself in different ways. Hence the heart disease appears in the midst of many other morbid facts, when it manifests itself accompanied by other symptoms referable to previous sufferings.

In both cases the morbid predisposition exists in the special morphology of the circulatory apparatus, but the mechanism by which the morbid condition takes place is very different. In the First Combination I have said the cardiac force is in play, and naturally is affected in different ways, according to the structure, functional capacity, and all the physiological elements that influence it. In the Second Combination, among the physiological phenomena which indicate the increased functional activity of the heart, by which is vividly maintained the arterial circulation—consequently the functional excitation of the whole organism—we see almost fatally arise, more or less quickly, more or less slowly, the morbid condition of the circulatory centre, as if that normally high power of the circulatory function was the physiological cause of the more rapid wear and tear of the organs comprising the circulatory apparatus. We can also admit that in these individuals the functional vivacity and resistance are the cause of the excess of function. It seems a paradox, but it is really a fact, that the robustness of the body generates the habit of abuse of function, and therefore increases the morbidity.

We shall now proceed to examine what the morphological conditions of the heart in the Second Combination are.

One sees immediately the cardinal fact in this : the heart is at the first glance robust, its musculature firm, and the left ventricle is, without doubt, proportionately larger than the right. We see at a glance that the calibre of the aorta prevails over that of the pulmonary artery. If we then take the necessary measurements, and if we can compare them with those obtained from another individual of the same age, sex, etc., we shall be able to put in clearer evidence that which I have called the cardinal fact—the predomination of the development of the left heart and of the aortic system—a fact on which the clinician has never been induced to make special research, but whose mention in comparison with the opposite one which we have seen in the First Combination is sufficient to reveal its importance and the necessity of taking it into consideration in the questions which we are continually discussing—namely, those of individual predisposition.

Let us suppose ourselves impartial observers in the presence of the cadavers of two individuals whose morbid conditions are known to us. Examining them externally, we observe the different form of the body; the different state of the circulatory phenomena, the prevalence of turgidity of the larger and smaller veins in one, the relatively greater size of the arteries in the other; the predominance of the fatty tissue in the former, of the musculature in the latter. We now open the cavities and note the different size and development of the vessels, of the mesentery, of the lymphatic glands, and of all the organs; we register the diversity of the primary and secondary morbid facts, and while thinking what the physio-pathological causes of the symptoms met with in life may be, we ask ourselves if by chance (the individuals having died from the same disease) the different morphological conditions could have contributed in such a way that the different symptomatology, like the different morbidity of both, must have been its most natural and necessary expression.

We then make this study on two healthy individuals for revealing all the differences between them. When subsequently we have to examine patients, we shall not be content with acquiring only the nosographic idea of the malady, but we shall endeavour to put it in relation with the special morphological conditions, and proceeding according to the precepts of morphology to value all the physiological and anatomical factors, we shall find how these will have contributed to it.

I believe that in both cases my conviction is as well founded and scientific as is the investigation of the minute alterations which the tissues present. I likewise believe that one of the causes of many alterations which are found in the tissues of the organs resides in the special morphology of the body and of its parts; consequently, the different microscopic findings will also receive light from this method of study.

The Second Morphological Combination, in like manner, presents variations, while preserving its fundamental character concerning the morbidity of the circulatory centre.

When examining Table XVII., we saw them indicated in the measurement of the great aperture and of the abdomen, but they were more clearly shown in the examples given in Table XVIII. Table XVII. offers us examples which I would call more pure, in which, therefore, we see a morbidity more distinctly characteristic and more marked clinical forms, without the association of morbid phenomena, which sometimes, as in the cases found in Table XVIII., one doubts as to whether they are wholly or partly the consequence of the fundamental disease.

For the purpose of our study it is, therefore, necessary to have an exact notion of the Second Combination in its typical form, where, besides the predominance of the left ventricle and of the arterial system in general, no other disproportions are met with in the other parts of the body—in the belly, for example, all show a degree of development which may be called typical.

This condition of things is not found in the individuals whom we can examine in the table on p. 305, excluding some exceptions.

One sees that almost in all, besides the excess of development of the chest, there is that of the belly. In fact, in Case 1 the *S.* being 156·5 centimetres, according to the rule the *Thc.* ought to be 78·2, instead of 93; the *Stl.* 15·6, instead of 16; the *Abl.* 31·2, instead of 32; and the *Bi-il.* diameter 31, instead of 24·9. These data correspond to the following indications, which, in other words, allude to the concrete fact in a sufficiently clear manner: here, that is to say, we have an individual in whom the chest is larger than the normal, and the belly, less owing to its length than to its breadth, bigger than that which should belong to the stature. With regard to the special conditions of the belly, and considering the relations which exist between the lines *Xu.* and *Up.*, we can maintain that in this case the hypochondriac regions are not greatly developed, consequently the

EXAMPLES REFERRING TO THE SECOND MORPHOLOGICAL COMBINATION.

	Morphological Combination.	Pathological Conditions.
1. ANGELA PASQUALOTTO	S. .. .. 156·5 Ga. .. .. 159 Thc. .. .. 93 Stl. .. .. 16 Abl. 33 { *Xu.* 17·5 *Up.* 15·5 Bi-il. .. .. 31 Heart large.	Left valvular endocarditis, acoustic phenomena of central insufficiency; hypertrophy and considerable dilatation of left ventricle. Relatively scarce phenomena of stasis in the abdominal organs, especially of liver and kidneys.
2. CONSTANCE ZECCHINI	S. .. .. 168 Ga. .. .. 169 Thc. .. .. 95 Stl. .. .. 20 Abl. 39 { *Xu.* 20 *Up.* 19 Bi-il. .. .. 35 Heart > than normal.	Cerebral hyperæmia, apoplectic form. Hypertrophy of left ventricle, not due to endocarditis. Up to forty-eight years without notable illness. Gourmand, polysarcia.
3. CANDIDUS MARTELLO	S. .. .. 164 Ga. .. .. 175 Thc. .. .. 90 Stl. .. .. 17·5 Abl. 34 { *Xu.* 17 *Up.* 17 Bi-il. .. .. 26 Heart>than normal.	Chronic bronchitis; discrete pulmonary emphysema. Central atheroma. Hypertrophy of left ventricle.
4. JOHN B—— ..	S. .. .. 166·5 Ga. .. .. 181 Thc. .. .. 104·5 Stl. .. .. 22 Abl. 34 { *Xu.* 15 *Up.* 17 Bi-il. .. .. 24 Heart normal.	Diabetes and obesity; diabetic sciatica, alternative of gravel. Tendency to excesses of table.
5. JOSEPHINE DAL POZZOLO	S. .. .. 160 Ga. .. .. 152·5 Thc. .. .. 96·5 Stl. .. .. 16·5 Abl. 36 { *Xu.* 19 *Up.* 17 Bi-il. .. .. 25·6 Heart greatly enlarged.	Polysarcia began at a young age. At fifty-six years presented all the inconveniences of obesity. Manifest traces of central atheroma and of cardiac alteration, hypertrophy, incipient dilatation.
6. MARIA BONETTI	S. .. .. 146 Ga. .. .. 152 Thc. .. .. 75 Stl. .. .. 15 Abl. 30 { *Xu.* 15 *Up.* 15 Bi-il. .. .. 26 Heart hypertrophied.	Hypertrophy of heart secondary to diffuse atheroma, symptoms of incipient left valvular endocarditis. Reached tardy age in excellent conditions of health.
7. CHARLES BUSATO	S. .. .. 160 Ga. .. .. 174 Thc. .. .. 88 Stl. .. .. 16 Abl. 32 { *Xu.* 20 *Up.* 12 Bi-il. .. .. 24 Heart hypertrophied.	Simple hypertrophy of left ventricle. At twenty-five years excellent nutrition; robust.
8. ZAMBON G——	S. .. .. 169 Ga. .. .. 180 Thc. .. .. 90 Stl. .. .. 17 Abl. 34 { *Xu.* 19 *Up.* 15 Bi-il. .. .. 24 Heart hypertrophied.	Pneumonia, with hæmorrhagic sputum. Aortic insufficiency. Recurrent apoplectiform phenomena.
9. JOSEPH PAGNIN	S. .. .. 163 Ga. .. .. 169 Thc. .. .. 90 Stl. .. .. 16·5 Abl. 38 { *Xu.* 20·5 *Up.* 17·5 Bi-il. .. .. 24·5 Heart hypertrophied.	Left auriculo-ventricular stenosis and insufficiency, without previous articular rheumatism.
10.	S. .. .. 167·5 Ga. .. .. 174 Thc. .. .. 92 Stl. .. .. 17 Abl. 34 { *Xu.* 18 *Up.* 16 Bi-il. .. .. 26 Heart hypertrophied.	Hypertrophy of heart, diffuse endarteritis, dilatation of aortic arch, innominata, subclavian and origin of common carotid arteries.

organs contained there do not greatly predominate ; but the pelvic cavity, on which rests the intestinal mass, which, as is known, is one of the anatomical conditions that influence the size of the pelvis, is, on the contrary, much larger than the normal.

Therefore, as regards the first case, the cause of the disposition to diseases of the heart is found in the morphology of the thorax and of the cardio-arterial system ; and in the morphology of the abdomen is found the reason of the speciality of the digestive function and of the special symptomatology which may accompany the fundamental malady of the circulatory centre.

Examining other cases, we shall obtain even greater light on the preceding.

Let us take Case 5. Here the *S.*, being 160 centimetres, the *Thc* should be 80, the *Stl.* 16, the *Abl.* 32, and the *Bi-il.* 25·6 centimetres. We find instead : 96·5 for the *Thc.* (16·5 in excess ; fundamental morphological character), 16·5 for the *Stl.* (0·5 in excess, which increases the value of *Thc.*), 36 for the *Abl.* (4 in excess), and 25·6 for the *Bi-il.* (proportional to the *S.*, according to the rule).

Well, wishing to express these facts otherwise, we can say that in this case we have an individual who, besides having a chest bigger than normal, in which are found the reasons of the morbidity of the circulatory apparatus, presents the abdomen excessively developed in length, while in the breadth of the pelvis it is developed in a proportionate way to the *S.* Further, the excess of development of the abdominal length denotes a predominance of the hypochondriac organs, including especially the liver. This fact will appear even greater if we remember that in Case 1 the excess of the chest in respect to the *S.* is 15 centimetres ; while in Case 5 it is 16·5—that is to say, the capacity of the base of the thorax within which are contained the hypochondriac viscera is absolutely greater. Otherwise one may say that in Case 5 the excess of development of the chest is due to two factors—that of the greater bulk of the thorax and that of the greater length of the abdomen.

And all this gives us the idea of other important facts which take a special part in the morbidity. To the absolutely voluminous liver correspond kidneys larger than normal, and the vena cava inferior, also more developed than it is as a rule in other individuals having the same *S.*, besides the proportions of the abdomen presented in Case 5.

We shall now consider briefly the morbid conditions. In Cases 1 and 5 the clinical form is notably different. It is plain that to have an exact explanation of everything one must have watched these two individuals from their youth till the moment in which the disease declared itself in both, because the occupation, hygiene, etc., always concur in modifying the organism and its functions. But here the morbid conditions are differentiated in such a manner that they certainly indicate the principal factors which operate in the special organization of the individuals. In both cases disease of the circulatory apparatus exists, but in the latter one finds obesity of the patient, which is absent in the former. And this makes us think of the invariable coincidence of the tendency to polysarcia, with excess of development of the abdomen, and with the character of diffuse lymphatism in the organism, which we have verified in Case 5, and as we shall see more clearly elsewhere.

The consideration of these two cases belonging to Table XIX. will help the interpretation of the others, in which we observe, first of all, the invariable coincidence of cardiac disease with the morphological notes expressing the relatively greater development of the chest and of the viscera contained in it, especially the heart. In the second place, we see the relationship which exists between the development of the belly and the state of general nutrition, besides the secondary symptomatology which follows or accompanies the fundamental malady.

1. MUTABILITY OF THE COMBINATION.

I have already mentioned that in infancy I have never found examples of the Second Morphological Combination to contrast them with those in Table XVII., and I have also indicated the reason, saying that in infancy the First Combination is generally represented. This, one can maintain, is the result either of a primitive organization not quite normal or of an irregular evolution of the body, so that one finds it subsequently in the adults constituting a complex of proportions, general and special to some organ, such as is met with in infancy, or even more disproportionate.

The Second Combination is naturally the result of the more regular evolution of the organism, which, ontogenetically considered, must be better constituted, for, in a general way, the individuals in question enjoy greater resistance, better nutrition, and stronger physical activity.

The error in the Second Combination begins to manifest itself when, towards puberty and after, the development of the thorax takes the upper hand. This fact, however, is not always very manifest ; hence it is that the individuals who appertain to this Morphological Combination may resemble those who approach nearer to what I have called the ideal type.

But the error of evolution of the organism which manifests itself owing to the development of the thorax may equally manifest itself owing to the development of the belly ; further, the different organisms which we are studying represent, in a word, different nervous capacity. Hence it happens that the Second Combination may also offer variations and a certain mutability which one meets with daily, without even suspecting that the reason is found in the primitive morphological conditions and in the adaptation.

With regard to the nervous system, it is necessary to mention that in individuals of the Second Combination it is, as a rule, capable of ready and energetic action, especially in the parts which govern the circulatory apparatus and the muscles ; hence the greater fitness of these individuals for muscular exercise and the great vasomotor nervous activity. One rarely sees phenomena of vascular paralysis before the alterations of the vessels commence ; on the contrary, one generally verifies a special strength of the pulse, energetic arterial contractions and an abundant arterial capillary circulation, always equal and uniform in every part, turgid after meals, or following mental excitement.

But this, which is characteristic of the individuals representing, so to speak, the type of the Second Morphological Combination, may present modifications in different individuals ; consequently its variations will have attributes that in part are to be ascribed to the particular modifications which the nervous system has caused in them. Here, likewise, we must search for the physiological and pathological manifestations referable to that general or partial state of the nerves which I have dealt with sufficiently when speaking of idiosyncrasies.

(a) *Mutability Regarding the Heart.*

The heart in individuals of the Second Morphological Combination may be normal or bigger than normal. When it is normal or bigger than normal, modifications may be verified in it as a whole or in some of its parts.

1. Individuals are met with who up to a certain age conserve almost a kind of protection, though they do not spare themselves. Later, without apparent cause, they lose their vigour somewhat. This makes an impression, especially because they have not yet reached the age of decadence, and retain their florid aspect and good nutrition. For this reason one might think that what they complain of is imaginary rather than real.

Nevertheless, their habits change, and even their mental character becomes modified. They are no longer desirous of taking muscular exercise, become subject to difficulty of breathing, bronchial catarrh, occasional vertigo, heaviness of the head, paresthesia of the head and of the extremities. The general sensation may equally undergo some change.

If they then fall under our observation, and we examine the heart morphologically, we shall find that it presents an abnormally large size, that the impulse is rather weak, though, owing to its being somewhat more extensive, it may give us the opposite impression.

I have said that the heart presents a larger size. It is necessary to understand this clearly, for we have two cases—that in which the heart has had previously a proportionate development, and that in which it has had an excessive development. How can we distinguish these two different cases ?

If the heart was previously justly proportionate, it would present its greatest modification at the base. The length of the latter compared with that of the left and of the right ventricle would be relatively greater. For example, the fist of the individual is equal to 9 centimetres, the base of the heart 10, the left ventricle 10, the right ventricle 11. Here the base of the heart, being 10, means that it is more than normal, because the fist is 9. If the 10 of the base expresses a pre-existing excess of development of the heart, the left ventricle ought to be 11, the right 12. If, however, the left ventricle is only 10 and the right 11, one must maintain that both have conserved, as regards length, their primary value ; the base alone being enlarged, one must conclude that, owing to the weakness of the most active muscle (in this case it is that of the left heart), a certain dilatation of the cardiac cavities has taken place where this alteration first and to a greater degree than in other parts presents itself.

If the heart before the appearance of the disease had been excessively developed—and it is understood that in this case the excess concerns all the organ, but predominates in the left ventricle—it later will present a modification referable to the base and the right ventricle. The fist of the patient is, for instance, 9 centimetres, the base of the heart 11, the left ventricle 11, the right 12. And this represents the condition of things before the appearance of the disease. Later, the following changes will be verified : The base of the heart 11, the left ventricle 11, the right ventricle 13. Here the modification has taken place, especially in the right ventricle ; consequently, the increase of the base is subordinate to the dilatation of the base of the right half of the heart. By reason of this the base of the heart will be increased, extending towards the right ; and it is precisely through the extension of the right end of the base from the mesial line that the border of the right ventricle must also increase.

In the foregoing case this does not occur, for the dilatation takes place at the base of both ventricles ; therefore the two ends of the base of the heart in respect to the mesial line find themselves in a similar position—there is no difference between them.

It will be said that in this case also the increase of the base must necessarily modify the sides of the cardiac triangle, which correspond to the two ventricles ; and this is true. They are modified in proportion to the increased length of the base. But inasmuch as what I wish to render evident is the most important fact of the greater increase of the base, in the examples given I have purposely omitted to mention the rest, and in this way also one will understand how to discern the two different cases.

It has also some importance from the clinical point of view, because everyone comprehends the difference that exists between a heart which begins to diminish in resistance in both ventricles and another heart whose right ventricle especially increases in size, since the left ventricle, though it has lost somewhat its functional vigour, renders evident an increase of pressure within the right ventricle and the right auricle called to perform a work of compensation ; still, both dilating, but having solid and robust walls, resist the pressure exercised by the blood-mass, and maintain sufficiently the requirements of the circulation.

Meanwhile, we can say that the conditions thus brought about do not constitute a true morbid state, a true cardiopathy in the clinical sense, but a functional condition different from that which existed previously, and which is capable of subordinating to itself the function of the organs which are influenced more directly by the changed hydraulic conditions.

The individuals in whom all this is verified have really changed their conditions of morbidity. The generic phenomena of which I have spoken disappear as gradually as they made their appearance. The normal state of health is restored, though with less corporeal resistance, and with susceptibilities which previously were unknown—that is to say, all those which have been determined by the changed circulatory conditions in the organs. One notes disturbances of the respiration with bronchial catarrh following common causes. Sometimes with these phenomena or unexpectedly (especially when the heart, previously normal, shows indications of asthenia, and is fatigued either by excessive muscular work, or by dietetic disorders, or by some other functional excess) a more or less severe attack of dyspnœa takes place, associated with painful symptoms in the chest simulating a stenocardiac seizure. And this is explained by the weakening of the heart and the onset of the pain, really cardiac, caused by the enormous tension of its cavities.

From these new conditions of the circulatory centre, with increase of pressure in the right cavity, which in some cases is considerable, arise the necessary consequences in the dominion of the circulation of the two cavæ, more manifest in one or in the other according to the conditions inherent to the primitive development of these parts. Therefore in this way different circulatory conditions will be produced in the superior and inferior parts of the body—in the head, thorax, and abdomen, according to the individuals—and in this manner, together with the primitive morbidity of the circulatory apparatus, others are acquired in the organs, including the nervous system, which feel the influence of the altered anatomical conditions.

In all this we see the different morphological factors, the elaborators of certain complex morbid states of the organism, of which the cause is usually sought in the external environment. The environment, habits, and hygiene also contribute ; but they are very slight and imperceptible factors, clinically speaking, unless they conspire with the most potent factor—the morphological condition. But before the appearance and during the progress of the disease of the circulatory apparatus, owing to the changes, other possibilities have occurred, which we have mentioned already in the preambles expounded when speaking of the transformation of the Morphological Combination. They are symptoms of chronic diseases of the respiratory apparatus or symptoms of the abdominal organs, or of the digestive apparatus, or of the uropoietic apparatus with altered functional conditions of the nervous system.

And all this, with very probable secondary alterations in the peripheral arteries in different organs, by reason of which, when at the autopsy one expects to find lesions which are quite in relation with the morbid conditions of the heart, one is surprised by finding this unexpected factor of secondary alterations in the liver or the kidneys or in the centre of innervation, and so forth.

Therefore, whenever I examine an individual and find even better morphological conditions, accompanied by the most reassuring protests of health, resistance, and robustness, I usually say that this excess of well-being may be the cause of unexpected sufferings, because I think that in the functional exercise and habits which generally exceed the limits of moderation and temperance one has the indication of extraordinary morphological correlations which are the cause of the functional power, and fatally the cause of the adaptation and morphological transformation, through which the individual, who seems to show signs of a long and healthy life, ends in displaying sufferings which are treated lightly because they are erroneously believed to be only passing, but which, on the contrary, increase and become complicated, and may shorten his life.

If we examine minutely a person of the soundest constitution in a state of perfect health, and we meet with indications of functional abuse in one part or another, we can positively maintain that, sooner or later, morbid phenomena will manifest themselves in other parts which, less resistant, are in necessary relations of functional correlation with those.

Considering now the changes which may take place in the

Second Morphological Combination by means of the heart—or, better, of the circulatory apparatus—one readily comprehends that one phenomenon is associated with another; that in the organism the phenomena of any part whatsoever cannot be studied separately; that it is not necessary that endocarditis and organic disease should manifest themselves in the heart to alter its special functional capacity, and become the cause of hydraulic disorders in various parts of the body; that, finally, those in whom we have maintained at most that at a certain period of life disease of the heart, to which they were judged predisposed, would manifest itself, before this and during these unexpected complications other morbid dispositions may have organized themselves.

(b) *Changes Regarding the Thorax.*

The number of my observations concerning this question is very small. The reason of this is readily understood when one thinks that it is impossible for alterations of the chest to take place in individuals in whom it has already reached the maximum development possible. Therefore the Second Morphological Combination does not offer—so far as I am aware—any change depending upon thoracic modifications and appreciable in the physiological and pathological relations.

Nevertheless, it may be observed that in two individuals, for example, having at the epoch of puberty the development of the thorax conformable to the proportions admitted in the Second Combination, the development may progress in one and not progress, or progress less, in the other. In those in whom it is arrested or progresses less the morphological combination may be modified in such a mode that it approaches the First Combination or represents incompletely the Second. We shall return to this argument when we discuss the Third Morphological Combination.

(c) *Changes Regarding the Abdomen.*

As results from the examination of Tables XVII. and XVIII., the individuals appertaining to the Second Morphological Combination may differ from one another also in the degree and form of the abdominal development.

Under this point of view they can be distinguished into two categories as follows :

1. Those in whom the *Abl.* is exactly proportionate to the *S.*
2. Those in whom the *Abl.* is $>$ than the *S.*

Both categories can likewise be subdivided according to whether

the line *Xu.* is $>$ than the *Up.*, and
the *Bi-il.* is $>$ than $\frac{4}{5}$ of the *Abl.*

Having made these distinctions, I would say that the belly of the individuals appertaining to the Second Morphological Combination may undergo alterations in those in whom its development is excessive, and different alterations according to whether the *Xu.* prevails over the *Up.*, and according to whether the *Bi-il* is excessive.

The knowledge of these relations is useful, not only for the study of the Second Combination, but for other studies, because if we remember what was expounded concerning the transformation of the individuals pertaining to the First Combination, we shall perceive that some things which we have just mentioned, and others which we shall add, can be uniformly applied for explaining facts common to the individuals of both Morphological Combinations.

In fact, as in the First, thus also in the Second, Combination it happens that in those individuals in whom the development of the belly is excessive, with increasing age the kind of general nutrition is transformed, and the tendency to become fat manifests itself. In both, with this also manifest themselves physiological and clinical expressions relative to abdominal plethora, with more or less increase of the hæmorrhoidal phenomena. In both, the greater the size of the belly, the greater the prevalence of the line *Xu.* over the line *Up.*, the more marked the above-mentioned conditions. In this case one can observe a greater expansion of the hypochondria. In both, with the excessive development of the *Bi-il.* diameter is constituted a kind of predominance of the abdominal cavity, owing to which cases of abdominal, and especially intestinal, sufferings will be verified without the appearance of hæmorrhoidal conditions, or with their slight or barely appreciable participation.

If, therefore, an individual of the First Combination presents in the abdominal cavity the foregoing anatomical attributes, one may meet with in him not only the special morbidity of the circulatory centre, but also that of the abdominal organs. This fact is revealed in the examples given in Table XIX. It naturally depends upon two circumstances : one is the notable degree of excessive development of the abdomen, so that the morbid predisposition increases, so to speak, in a fatal way ; the other depends upon the quality of the hygiene, or, better, the dietetic habits followed by the individual, for the reason which has been given elsewhere—namely, that the digestive organs are included among those which more easily adapt themselves to the functional requirements to which they are subjected.

Therefore to these things of a morphological order correspond others of physiological and clinical order. The individuals who have an excessively developed belly are, or will become, gourmands. Being capable of much physical work, they feed the organism in proportion, and as they abuse habitually their powers of physical work, they equally abuse their alimentation ; in fact, in the majority of cases this abuse exceeds the limits indicated by the amount of work, and is due to the erroneous ideas held by most men on the need of food, and to the almost absolute ignorance in which the majority live regarding the best alimentary hygiene.

If, then, besides the tendency to be a gourmand one has that of taking copious quantities of drinks, the hygienic error becomes greater, and leads to the following consequences : (1) Extraordinary distension of the intestine, which gives rise to injurious modifications in the respiration, and consequently in the circulation, especially of the right heart ; (2) a plethora, though transitory, which induces greater cardiac work ; (3) a greater excitation of the vasomotor nervous system, which, while it satisfies the needs determined by the excessive alimentation, gradually leads to alterations in the vascular apparatus by reason of excess of work.

It is said that he who drinks much eats little, and *vice versa.* But this is not true for all. Certain sayings like this draw even the most capable persons into mistake if they be systematically professed. It is true that in many cases those who eat much drink little, and *vice versa ;* but in many others it happens that individuals exceed both in eating and drinking. And the class of individuals whom we are examining may give examples of the former and the latter without disturbing the order and punctuality of their functions for a certain lapse of time. This is so true that when we are consulted by these individuals the first thing they tell us is that they do not give rise to disorders, because in *that order* in which they have kept themselves they have not had immediate damage from it.

But when the moment arrives that, owing to the special morbidity of the heart and of the arterial system, the hydraulics of the organism are not regularly served (as we have already seen can happen in some cases), these abdominal sufferings declare themselves, which exceed, both in their importance and duration, the causal factors to which they are commonly attributed. Then also, by means of careful examination and adequate weighing of the physiological and clinical facts, one will be able clearly to understand the part which belongs to the primitive individual organization, and that which belongs to the individual transformation to which the dietetic habits will have contributed. The Second Morphological Combination having for its special character morbidity of the circulatory apparatus, will also have acquired a morbidity more or less marked in the viscera of the abdominal cavity.

2. PLETHORA.

I must now discuss a question which has been suggested to me by what I have said above. Indeed, we know individuals who, being provided with a big chest and a well-developed arterial system, have been capable of transforming themselves, especially regarding the belly, and who in consequence have acquired organic habits through which they are ordinarily called *plethorics*.

As I have said in other works, *plethora*, though much discussed and even confuted lately, is a verifiable clinical fact, just as it is a fact that individuals become plethoric as they grow older. Individuals, therefore, are not born plethorics ; but are born with a special disposition, which, if it be favoured by the necessary hygienic conditions, subsequently manifests itself morbidly with certain phenomena that correspond to some others pertaining to the morphological order considered above.

A true doctrine on *plethora* does not exist. We possess only the facts ; but because these are not capable of explanation by physiology, and the hypothesis of the pathologists would wish to make them depend upon *polyæmia* (πληδώφα, *repletion*), they deny plethora, and consequently the facts which clinicians observe would appear to lose a great part of their importance. Things have arrived at such a stage that it seems almost ridiculous to some to speak of plethora.[1]

Yet, though from the studies of Andral and Gavarret it has been impossible to establish if that general morbid condition of the blood which is called "polyæmia" can be truly determined, though physiological experiments have been instituted for demonstrating that an excess of material cannot be contained in the circulatory system, the clinical facts always equal present themselves, and still await an interpretation.

If it be desired, we will give up the word *plethora*, but we shall keep to the facts.

We shall now examine them without preconceptions.

Individuals of robust aspect, strong skeleton, and richly provided with muscles ; general colour of the skin very vivid ; neck more or less short and fat ; big chest and belly ; heart more developed than normal, with impulse very distinct, arteries of the body large, resistant, strongly pulsating, and though no signs of any alteration whatever exist in the central circulation, the visible subcutaneous veins are turgid ; appetite ravenous, intestine voracious ; nerves excitable, resistant : the excellent nutrition, great strength, and almost excessive health render these individuals enviable.

But there comes a time in which the scene changes : they complain of extreme fulness of the vascular system ; the bright colour of the skin, especially of the face, becomes red ; the eyes are tense and glistening ; the arteries are also tense ; the heart and liver increase in size.

If the art does not provide, other phenomena, which vary according to the cases, may present themselves. They are cerebral torpor, drowsiness, noises in the ears, flashes of light, vertigo, heavy breathing, or even dyspnœa and cough. It may happen that the cerebral symptoms or the pulmonary are followed by hæmorrhage, or by a hæmorrhoidal flux, or by rhinorrhagia ; if the hæmorrhage discharge externally the patient improves, and he may state that on other occasions he had been relieved of his symptoms by the abstraction of blood. All these individuals, in any case, support admirably the loss of blood, and make blood very quickly ; subjected to the more rational treatment of indirect abstraction, they improve equally, and are even better prepared to avoid the dangers to which they are exposed when, the crisis passed, they dedicate themselves vigorously to that kind of life which isnothing but the exaggeration of the functions of nutrition.

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[1] I mention simply by way of curiosity that an ordinary professor of one of our universities refused his vote in favour of a thesis presented for the degree because abdominal plethora was spoken of in it. This term excited a holy horror in him, because he said it was of ancient date, and in these days it was a proof of ignorance to talk about *plethora* (!). I thought at the time, and still think, that it was a proof of little wisdom to get angry about a phrase, while the natural facts hidden in it are not fully known.

What are the differences between these individuals and those of the First Morphological Combination even if transformed ? Here also we see cases in which a certain excess of nutrition manifests itself ; here also we notice cases in which we find the indications for direct and indirect abstractions ; but a few remarks will be sufficient for enabling us to comprehend the enormous distance which separates the two types. In the former we find the heart disproportionately developed in the right half, an aortic system more or less constricted, the pulmonary system more ample, the respiratory organ slightly developed, liver originally bigger, the belly relatively more bulky, and the lymphatic tissues and fat more developed ; in the latter, on the contrary, we find the left heart, the arterial tree, and the lungs prevailingly developed, and the muscles more developed in comparison with the lymphatic tissues ; in the former little or no resistance to blood-letting, in the latter indifference to the same ; in the former the necessity of modifying the diet in such a way as to prevent the extreme repletion of the venous tree ; in the latter in such a way that the extreme repletion of the whole circulatory system is not affected ; in the former, though the blood-mass appears exuberant, on microscopic examination the red corpuscles are seen to be relatively scarce, and among them are an abnormal number of white corpuscles ; in the latter, on the contrary, the red corpuscles almost occupy the microscopic field, inasmuch as the white corpuscles are very rare, and one barely perceives some small free spaces.

In both cases there are an excessive introduction and an excess of intestinal absorption, but here the differences begin. In the transformed cases of the First Morphological Combination the symptoms of abdominal plethora predominate ; in the transformed cases of the Second Morphological Combination the repletion of the general circulatory system, especially of the arterial tree, predominates. In the former, if cardiac phenomena arise, there is an increase of the area over the right ventricle, with symptoms of cardiac stress and insufficiency ; in the latter we have increased action of the heart ; in the former, by reason of the great development of the venous tree, liver, and lymphatic tissues, there is a kind of slackening of the circulatory process in these parts ; while in the latter, owing to the predominance of the arterial tree to its capillary expansions, the circulation and the processes depending upon it, including the secretions, are effected with alacrity and greater intensity.

In both cases, having adapted opportunely the hygiene to the physiological requirements for the purpose of combating the morbid facts which we have mentioned, we see the organism gradually returning to very different conditions. The morphological facts and the dispositions will remain, and in consequence the tendency to the renewal of the preceding conditions, but we shall see the symptoms of that general condition which has passed and passes under the name of " plethora " disappear.

3. PLETHORA ACCORDING TO THE CONCEPTIONS OF MORPHOLOGY.

If we now wish to collect our ideas, and say what one has to understand when one speaks of *plethora* and of *plethorics*, it seems to me that one can have the following conceptions of them :

Plethora is that state of blood-repletion which is observed in certain individuals endowed with excessive vascular development, with special trophic capacity increased by habitual excess of diet—*excess desired by the instinctive voracity of the individual, or by the requirements of alimentary hygiene.* In every case the degree of plethora is proportionate to the primitive capacity of the vascular system, and to the possible alterations which take place in this through the law of adaptation to the requirements of alimentary introduction and absorption.

In this connection one must remember that individuals are not born plethorics, but become such when the two necessary conditions obtain—namely, that of excessive alimentary introduction and the primitive morphological disposition of the great circulatory apparatus of conforming itself and evolving in that mode which corresponds to the digestive and absorbing functions as well as to the type of its primitive development, prevailingly *arterial, or venous, or lymphatic.*

We must distinguish—

Arterial plethora, which is met with in the individuals in whom the arterial tree with corresponding development of the left ventricle of the heart predominates ; and

Venous plethora, which is observed in the individuals in whom the venous tree with corresponding development of the right heart predominates.

In this way we have avoided the question raised concerning the possibility of an excessive quantity of blood in the circulatory torrent, and that concerning the excessive number of red corpuscles which they wish to find in plethoric individuals. The former question is useless, because in reality in the plethoric the true condition consists, above all, in the excessive development of the circulatory system, and in a corresponding activity of the heart. Consequently the excess which exists is, above all, in the entire circulatory system in respect to the organism and in its relatively greater capacity.[1] Therefore, if one should wish to confute the conception of plethora, invoking those experimental results obtained by artificial vascular repletions, and which demonstrate that the bloodvessels cannot contain a greater quantity of blood than that which they normally contain, I would observe that if similar experiments were performed in a plethoric, the same results would be obtained ; but this would not do away with the clinical and morphological facts which we have briefly examined. These experiments will demonstrate at most that, when in plethorics the internal pressure becomes excessive or the vascular resistance is weakened, morbid conditions may declare themselves which clinical experience has already verified.

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[1] In confirmation of my observations and views on plethora, I find that Ziegler says that not only the observation of individuals having a robust and strong heart, a pulse large, full, expansile, with the tendency to active congestions, but much more the necroscopic findings, which show unusually ample venous and arterial systems, both turgid with blood, and organs rich in blood, and the heart hypertrophied independently of valvular disease or renal malady, enable us to comprehend that in these cases the heart must have increased its special activity in order to maintain the circulation of the exuberant blood-mass (*Lehrb. d. speciel. pathol. Anatomie,* 5 verber., Auflg. ii., p. 5). If the author had studied the argument from the morphological point of view, he would certainly have solved the question in the sense which I uphold. Hayem says : "It is probable that robust individuals with large and numerous vessels, who have their face coloured and grooved by dilated capillaries, the mucosæ very vascularized, and of a dark-red colour—in a word, all the attributes of the sanguineous temperament—have a blood-mass more considerable in proportion to the body-weight than that of individuals of the nervous or of the lymphatic temperament." And farther on : "The facts of this order [that is, those which plethoric individuals present clinically] have been observed too frequently by capable physicians for one to deny their value in an absolute manner" (*Du sang et de ses altérations anatomiques,* pp. 421 and 422. Paris, 1889).

Then with regard to the question of the number of the red corpuscles, I am confident that the numerations made, and those which may be made, will never give the just criterion for recognizing whether plethora exists or not. However valuable these researches may be, I do not think they can solve such a big question as this. They were made, it is true, following the old conception of plethora, and consequently the research may have seemed necessary; but now, having substituted the morphological conception for the old theories, one understands that their value is little or nothing.

In reality *arterial* plethora and *venous* plethora are different things. We have two different constitutions—I mean that the individuals resemble two different plants which draw nourishment from the same soil, but transform themselves in a mode special to each. The composition of the blood cannot be identical in all: each individual has his special blood-mass.[1]

Further, in this connection one must distinguish plethora according to whether the lymphatics pour into the blood a quantity of material relatively more or less abundant. In this case we have what I call precisely *lymphatic plethora*, which may easily be met with in the cases where, for morphological reasons, I have said that the plethora is *venous*. There is, then, a *serous plethora*—that is, a particular state of dyscrasia different from that of true plethora, which, however, like this, can be considered the effect of a special organization of the vascular system relatively developed in excess with an exuberant quantity of hydræmic blood. This is not observed as a physiological fact. Although there are individuals who from birth have thin blood, comparatively scarce in red corpuscles, they never present the general plethoric condition. Then the plethorics up to the time they become such give no indication of a hydræmic dyscrasia; and, on the other hand, they may become hydræmic by the slow influence of the morbid processes through which they fall under medical observation. Well, it seems to me reasonable to admit that in these exists a serous plethora, because the hæmopoietic functions are altered in them, in such a way that the watery portion of the exuberant quantity of blood substitutes by physiological law the corpuscular elements. Consequently we can admit:

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[1] With regard to the average quantity of blood attributed to the human organism, we have data such that they confirm fully what I maintain. Beaunis says that the quantity of blood corresponds to one-thirteenth the body-weight, Bischoff to one-fourteenth, Weber and Lehmann to one-eighth. And as regards the number of the red corpuscles, Hayem has found in robust men more than 5,000,000 for every cubic millimetre, while in weak individuals he has found 4,500,000. These extremes denote that also in the study of the blood one must take care to recognize what is special to the individual, because it is not strictly scientific to attribute to him what is indicated by the average resulting from individual observations.

1. ARTERIAL PLETHORA, *in which there is a quantity of blood exuberant by reason of the excessive development of the arterial tree;*
2. VENOUS PLETHORA, *in which we have an excessive quantity of blood in the excessively developed venous tree;*
3. LYMPHATIC PLETHORA, *which is nothing but the preceding combined with excessive development of the lymphatic organs and lymphoid tissues;*
4. SEROUS PLETHORA, *which may occur as a modification of the foregoing forms owing to hydræmia produced by exhausting maladies.*

As is seen, the division of plethora that I have proposed is founded upon solid conceptions, which are those that refer to the individual organization. And it is useful to the clinician, for it enables him to discern morbid facts which, having different origin, present different therapeutic indications, as I have already mentioned. Other divisions of plethora must be made, as we shall see presently when we deal with bleeding.[1]

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[1] Jürgensen, speaking of the indications for blood-letting, makes the following remark with regard to the pathological condition of plethora: "Here it must be stated that one alludes to a thing whose existence has not been demonstrated, and which, from the present scientific point of view, cannot even be admitted as a permanent constitutional anomaly. With this falls every further consideration regarding the utility of bleeding in plethora" (*Handb. d. allgemein. Therap.*, 1 B., p. 218, Leipzig, 1880). This absolute assertion of such an able clinician, concerning a fact which can be discussed in its physiological expressions, but cannot be denied, impresses one. Jürgensen decides from the present

4. BLOOD-LETTING.

He who desires to know the different doctrines and the warm diatribes which have been written regarding blood-letting must consult the literature of the last quarter of a century; this is not the place to discuss the old therapeutic doctrines, but to examine the facts in order to understand them according to the principles of morphology.

The facts are these:

1. Blood-letting is practised according to indications deduced from the conception of plethora and from the conception of inflammation.

2. The indications for bleeding are modified with the changing of the physiological and pathological theories.

3. In spite of these, the practice of blood-letting has never definitely disappeared from therapeutics.

4. Statistics have not contributed to cause the practice of blood-letting to disappear, but only to moderate the theoretical views of the phlebotomists, or those of the systematic abstentionists.

5. After so much discussion, those who are known as independent observers, and in therapy opportunists, advise blood-letting in definite circumstances, because it may be useful, and because it is useful, without regard to theories, complying with the symptomatic indications.

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scientific point of view; but it is better to say from the *experimental* point of view, for it is specially owing to certain results of experimental physio-pathology that arguments have been found for discussing and denying the possibility of plethora, understood as an excess of blood in the vessels. And it is from the *scientific* standpoint—that is to say, of the science of organization, of morphology —that one undertakes to explain the physiological and clinical facts by means of a new conception of plethora, which is an excess of development of the vascular system. Be this as it may, it does not seem to me just to deny a fact established by daily clinical observation solely because it cannot be illustrated experimentally. It would be better to keep to the facts and await the explanation from the progress of the science. And how can one deny the physiological and pathological facts which represent those particular conditions which are called *plethora?* And how in the presence of these facts, which also require explanation, can one pass them by as if they were non-existent? What can one substitute for the conception of plethora? If this conception is contradicted by experiment, the facts can very well have another interpretation. And then, still retaining the word *plethora*, we will surround it with new light, thinking only of the differences of organization of the individual vascular system, and we will say: The old pathologists, less endowed than us by science, have confused *excess of vascular fulness* with *excess of vascular development.*

From all this we can infer that one must not be an abolitionist of blood-letting by system. There are physio-pathological facts which justify its application, on the knowledge of which depends the knowledge of the truly rational indications for blood-letting.

The physio-pathological facts are those which concern the plethoric condition in general, and the different forms which it presents in individuals in particular.

From this one derives that *the true indication for blood-letting is obtained more from the diseased individual than from the disease.*

I hope that these propositions will be made clear by what I shall expound under the guide of experience.

The history of blood-letting reveals a curious fact—namely, that it was practised with a preventive scope; and if we stop to consider a certain number of the cases, not all, in which this practice had the precautionary scope, we can say that we are assisting at a true clinical experiment.

In fact, we find before us individuals, all plethorics, who, besides the characters of robustness, have the tendency to be large eaters—a tendency which induces in some the habit of introducing much more food than they should, according to the limits which a strictly physiological balance would assign them.

These individuals from time to time, either under advice or driven by their own sensations, have recourse to either venesection or the application of a leech to the anus, and since the crusade against blood-letting was proclaimed, to methods of lowering treatment.

Instead of "have recourse to venesection," it would have been better if I had said "had recourse to," for in reality the number of those who to-day subject themselves to this practice is much diminished. Nevertheless, there are some who do so, and my experience is also of to-day.

If we examine those who prefer venesection to leeching, and *vice versa,* we find that the choice is not accidental, because the former have the characters of arterial plethora, the latter those of venous plethora, which in the large majority of cases presents itself with the phenomena of abdominal plethora.

This constitutes a very important fact, which agrees admirably with the morphological data.

Another equally important fact is offered by clinical experience, and it is that some patients who formerly were accustomed to venesection, in spite of the prohibitive therapeutic teaching, end by preferring leeching of the anus. And this also agrees with what we see happen through the transformation of the morphological combination, when the symptoms of abdominal plethora predominate.

Before entering further into this question I desire to forestall an objection which may be raised by those who believe my reasoning deprived of foundation, because nowadays one rarely meets with individuals who uphold the practices of the old school of medicine. This, superficially considered, might appear to take away all importance from the facts that I am considering, for instead of representing natural conditions inherent to the organization, it would represent erroneous doctrines which have been condemned and discarded.

If the practice of blood-letting be not so frequent as formerly, it is none the less true that there still are plethoric individuals, and that they, according to the dominating physiological and pathological ideas, give themselves to salutary practices which at bottom aim at precisely the same objects which they obtained with systematic sanguineous depletions. There are other modes of depletive treatment, especially that of purgative waters. Therefore, the facts which I have placed as the foundation of my argument remain ; and if they should undergo some modification in their form, they nevertheless will remain in substance.

And it is owing to this that I find it useful to declare, as I have done on other occasions, that, dealing with blood-letting, I intend to refer to all kinds of depletive treatment, because that which for me is highly important is not the form, the method of treatment, but its effect and its ultimate scope. I speak especially of bleeding, because it is precisely of this that I wish to put in relief the indication which one has according to the views of morphology, and because with it the pathologists, starting from the most varied theoretical conceptions, never from those which to-day have been derived from the natural history of man, occupy themselves very much ; so that one can consider it certain that, looking at the practical question from a completely new point of view suggested by the science become more positive, one can untie more easily what I would call the Gordian knot of this question.

However, I believe that, although it is true that nowadays very few follow the practice of blood-letting in the treatment of diseases and that of preventive bleedings, the examples, without reaching the enormous figures of one time, would become more numerous if things were considered not from the point of view of the old doctrine on blood-letting, but from that of the facts ; for at the present time what I would call an act of repentance has begun to manifest itself in the clinicians after having been systematic abolitionists. And this has happened when no new theory has arisen to convert them, and when paying homage to the recent hypotheses they practise bleeding in some cases (pneumonia, for instance) without having to deplore its consequences, as we shall see hereafter.

This fact has strengthened in me the conviction that my observations have a commendable side, and that what I have said concerning the indications for blood-letting obtained from the special morphology of the individuals, although it may not be entirely exact or complete from the scientific standpoint, nevertheless opens the path to new investigations for those who by empiricism have been led to adopt the practice of bleeding.

I have said that the practice of blood-letting with a preventive scope finds an indication in plethoric persons, and that these, as a rule, derive advantage from general or local bleeding (leeching the anus), according to whether one or the other form of plethora prevails in them.

I am very far from accepting unreservedly the facts of ordinary medical practice as they present themselves to me, and I feel it necessary, after having subjected them to physiological criticism, to censure them for the following reasons :

1. Because I do not always see that the use of the abstraction of blood is necessary in those who have recourse to it, not knowing how to follow a better hygiene.

2. Because some have recourse to it with the idea of obtaining in the shortest time possible the salutary intention.

Nevertheless, having made the necessary reserve according to these thoughts dictated by experience, it always remains that there are individuals who by virtue of their special pathology are fatally plethoric, and require to have recourse to the depletive treatment, employing different means, including blood-letting.

It is observation, not theory, which enables me to assert this. It would be theory if I had said absolutely that there are not individuals who require to have recourse to sanguineous depletion, because with this proposition I would have shown that I had not sound knowledge concerning the different morphological individuals, nor a practical conception of the exercise of life, nor just ideas regarding certain conditions of the organism which, with the appearance of health, express the tacit formation of some pathological facts.

When we maintain that there are plethoric individuals, one must not understand by this a condition of things identical for all of them ; besides the difference which we have established between the various forms of plethora, the different degrees of the plethoric state must be recognized. All plethorics have necessarily a particular rule of hygiene for living immune from morbid consequences, but the rules are more or less efficacious according to the individuals. Therefore when, even in spite of the best hygiene, the necessity arises of having recourse to a curative method, the effects of this are not in all equally practical and sufficient. When we become aware of a certain morbid expression of the plethoric, the expressions declare themselves in such different forms and intensity that it is necessary to employ different remedies. If, then, one considers that good hygiene in its turn is a term which varies in value according to the theoretical ideas of him who advises it, and to the docility of him who is advised, one comprehends that in practice arise inevitable facts, as the plethorics—or, better, some plethorics—fall necessarily into the condition which offers a special indication for depletion ; when that is owing either to the enormous repletion of the arterial system and the concomitant orgasm of the vasomotor apparatus, or to the grave repletion of the abdominal venous system, with persistent suffering in the belly, one foresees the preparation of conditions which indicate the passage of the physiological into the pathological state. I do not wish to repeat here what I have said concerning the symptomatology of these cases ; these notes are sufficient for calling to mind the physiognomy of the plethoric individual, which tells us his morphological condition, and requires a remedy.

We shall next consider other facts ; we shall observe what happens to these plethorics suitably arranged in groups.

In a first group we shall include those who by reason of the indisposition which seizes them are deprived of appetite, and spontaneously, or by the advice of the doctor, have recourse to purgative treatment. But inasmuch as some physicians have almost a kind of horror even for this, it is not carried out according to the rules of the art. Meanwhile the indisposition continues, the digestive functions become disordered, and in this lies the principal reason of the improvement which gradually sets in, because the amount of food introduced is necessarily limited, the process of digestion is altered, and the intestinal absorption diminished. For these individuals the art does little —too little. All proceeds in such a way that students and physicians and laity find the means for maintaining—the former through defective observation, the laity through ignorance—that nature cures itself. But the example of these cases, if it suffices apparently to justify the little observation of some physicians, it also suffices to ingenerate in the patients opinions which are injurious, for, as I have said, all the cases are not equal, and some patients may become worse, as we shall see.

In the second group we find those who at the first morbid sensations, thanks to the special condition of their nervous system, do not suffer much either physically or mentally, consequently they can continue uninterruptedly the exercise of their functions. They work, eat and digest well, and at most consent to take a very mild treatment ; they abstain from some kinds of food, limit their stimulant, and take some glasses of purgative water ; but all this in an irregular way, and in a measure much less than is necessary. Many of them await the season for the " cure " at some spa or other. Meanwhile the disorder continues, and while they are looking for improvement, a hæmorrhoidal loss, or a nasal hæmorrhage, or, more rarely, hæmatemesis, unexpectedly occurs. The phenomena caused by these complications having disappeared, a regular order of things is re-established. They will then go to the spa by way of precaution ; but it very frequently happens that, in spite of this, the hæmorrhagic conditions will reappear the next season. These, considered according to the views of morphology, are a true revelation : they demonstrate that in these individuals exists a constitutional condition which indicates, above all, a severe method of hygiene, which is rarely adopted, and the advantage which would be derived from a proportionate depletive treatment, which is not practised owing to purely scholastic views.

In the third group are those who before or after having been attacked by grave symptoms have been induced to acquire the habit of blood-letting. I am not speaking of those, as I have mentioned elsewhere, who contract systematic vicious habits, but those others who, interpreting scrupulously their requirements, decide upon the practice of blood-letting or of leeching alone, when it, according to their experience, combats that condition of excessive repletion which could not have been combated so quickly otherwise. Among them we find not only those who have a large and depraved appetite, but also those who seem to make blood even from aliments of the lowest nutritive value. We shall find examples of the latter especially when we deal with the Third Morphological Combination.

After this review we can formulate our thoughts in the following propositions : *Admitting the fact that plethoric individuals exist, it is natural to conclude that they require a special hygiene for suppressing the influence of their morphological condition ; but the hygiene, not being punctually followed, as experience shows, not knowing at present how to modify by means of this the special morphology of the individual, and the hygiene not even being carried out as it should be for moderating the natural tendency of the constitution of the individual, the depletive treatment with a preventive scope is necessary, and general blood-letting or leeching the anus is sometimes useful.*

Having dealt with the general indications for blood-letting—considered as a general and local depletive, as venesection and leeching the anus—we shall now make some observations on the special indications derived from the morphological conditions of different parts of the organism.

I have already had occasion to reveal that that which may be the character of the whole organism—namely, the plethoric constitution—may be the character of one or more of its parts. Hence the reason through which in individuals one may have the phenomena of plethora more marked in a definite part ; and even in individuals who are very far from showing constitutional plethoric symptoms these phenomena may manifest themselves with their most characteristic signs in some part.

The exaggerations of the schools which created the medical phlebotomists have also in this been profitable to the science, because by the systematic prescription of bleeding they have almost unconsciously instituted a grand clinical experiment, of which we now receive the results.

That which I am about to expose refers especially to the individuals who appertain to the First Combination, in whom we have seen predominate weakness of the organism, and the lymphatic and scrofulous constitutions.

Studying this in its primary manifestations and successive evolutions, we have verified that at first, by virtue of defective organization, exists a disproportionate development between the pulmonary artery and the aorta in such a manner that this presents a definite degree of aplasia; while that being larger, and the entire respiratory organ being relatively less developed in respect to the dimensions of the body, represents a state of partial plethora, to which is due the special morbidity of the individuals. We have also seen that when in these individuals such alterations are brought about, through which we have understood the morbidity can be modified, analogous conditions to those met with in the dominion of the pulmonary artery may be established in the dominion of the vena portæ or in that of the inferior vena cava.

Well, these individuals, who are in reality under the influence of a partial plethora, and who, before falling a prey to the symptoms proper of the disease of the respiratory apparatus, or of the abdominal maladies to which they are predisposed, offer phenomena that indicate the slow but progressive formation of the morbid processes which we call constitutional, will improve by employing a lowering treatment—a treatment which seems to be in contradiction to the requirements of the general state, but which, in spite of the fact that it is still disapproved of, is within certain limits and in certain cases to be advised. Hence it is that in those for whom neither hygiene nor the treatment has been prescribed in a mode adequate to the morphological exigencies, we see conditions appear which depend upon the circulatory contingencies that I have noted. It is sufficient to recall the hæmoptysis which takes place before the initial symptoms of pulmonary phthisis have been recognized in the respiratory apparatus, to which the hæmoptysis may be the incentive or the precursory symptom ; but in the cases specially considered by me it is not followed by the disease which has been suspected and precociously diagnosticated.

And I wish to record other cases of hæmoptysis occurring in patients under treatment for disease of the pulmonary apex, and treated with superalimentation. Here the hæmoptysis depended upon the artificial plethora alone. A youth judged tuberculous at eighteen years of age, with persistent hæmoptysis, was admitted into my clinic, and boasted of the fabulous amounts of food which he had consumed. The symptoms of tuberculosis were present, but the pulmonary congestion was extensive. And to prove the truth of my assertion, I ordered my experiment—that is to say, the treatment which I believed suitable for him : Reduction of the alimentation to the bare needs of the organic balance ; revulsives on the chest for modifying the congestive state, aerial and anticatarrhal medication. The hæmoptysis gradually ceased, the catarrhal conditions reduced themselves to a minimum, the morbid focus became circumscribed as the patient's health returned, and he was sent to a climatic station. Besides this case I could give other cases of a similar kind, in which the pulmonary plethoric state was combined with the initial symptoms of tuberculosis, owing to which I have convinced myself of the advantage of not adopting systematic projects of treatment.

In all these cases, if by means of sound criticism we examine the individuals who have been treated, according to the old teachings of medicine, with the depletive method, we shall find without doubt reasons of protest against the exaggerations of the systematic treatment ; but we also find cases in which the truly salutary effect of this curative method cannot be denied. That which I myself declined to admit on the suggestion of the theories mentioned, certain facts made me think possible, then my clinical experience demonstrated it to me, and I finally explained it, analyzing the facts by means of the criteria of morphology.

And if we consider how other curative methods recently introduced reach the aim of preventive medicine, we see that they do so when they are capable of modifying the above-mentioned hydraulic phenomena to which particular conditions of environment correspond ; but when they are not, those phenomena which show the unchanged persistence of the conditions which we shall briefly call of pulmonary plethora, and which therefore present the indication for the direct depletive treatment, are not avoided.

These considerations enable us to admit also a *local plethora* that, owing to the particular morphological conditions from which it results, seems the variety that we have mentioned.

Further, when, for instance, we recognize the existence of partial plethora in the dominion of the vena portæ, or in that of the inferior vena cava, we must grasp all that is connected with this special local circulatory condition. Therefore, for recognizing exactly its influence and the morbidity which is derived from it, it will be sufficient to recall the intimate relations that obtain between the exuberant venous circulation and the lymphatic circulation and the function of the organs which feel the state of diuturnal repletion. This consideration is even more important with regard to the cases in which the venous plethora coincides with a certain predominance of the lymphatic elements, and their marked tendency to manifest phenomena of irritability, as occurs, for example, in the lymphatic tissues of the abdomen, in the system of the cutaneous glands, in the tissues composing the joints of the limbs, etc. In these cases the knowledge of the local plethora, and its due valuation as the factor of morbidity in the part, will give us practical conceptions, both as regards the hygiene and the treatment, as we shall see.

Having grasped, as I have said, all that which is connected with local plethora, one will succeed in comprehending the morbidity also of the organs which are indirectly in relationship with the circulation of the vena portæ and of the inferior vena cava. Consequently in this we find one of the principal etiological factors of diseases of the genital apparatus, of the uropoietic apparatus, and of the spinal nerve centres, besides those of the abdominal sympathetic. Wherefore, if on the one hand it be necessary to discover the etiological factor, on the other it is useful to have it before us when we institute the curative treatment, in which will be included the eventual indication of modifying with suitable measures the local plethoric condition.

And now we shall enter into the order of clinical facts determined, because up to here we have considered the indications for blood-letting chiefly as a means of preventive treatment.

If, as there is no doubt, the physiological conditions exercise a special influence on the mode in which diseases arise and manifest themselves from what we have exposed, it results that for any malady whatsoever *the indications for blood-letting must be derived first of all from the exact knowledge of the special individual morphology; in the second place, from the precise estimation of the pathological factors through which the special plethoric condition proper of the individual is rendered more severe, more grave, and perhaps dangerous.*

In this proposition are included two terms whose physio-pathological capacity it is especially necessary to know, and directly one meditates on them one will understand, according to the biological principle from which they are derived, the facts concerning the functions of physiological correlation.

Indeed, clinical experience demonstrates that pneumonia, for example, presents a different clinical form according to whether we consider it in a plethoric or in a non-plethoric individual ; a different form according to whether we have to deal with one or another kind of plethora.

To those who take pneumonia in gross, and content themselves with the rigor, fever, dulness of the chest, tubular breathing, rust-coloured sputum, and the presence in this of the pneumococcus, for concluding that the disease is equal for all, and that, as regards certain differences of course and of accidental symptoms, it is necessary to think also of the etiological varieties of pneumonia, of the dominating morbid form, etc., I would answer that all this is not sufficient for knowing as deeply as is possible not only the pneumonia, but also the pneumonic ; that for arriving at this degree of clinical precision one must enter into the intimate organization of the patient, especially if one wishes to proceed with rational and physiological criteria to the discussion of the case and of the treatment which is suitable for it alone.

We go in trace of the true indication for blood-letting, after having established that there are plethoric individuals who present certain conditions which are an anatomical basis on which arise morbid phenomena that are not the expression of the morbid cause alone—conditions which one can say are the opposite to those which other individuals present. Consequently it is necessary to establish whether these special conditions have acted, either because the symptoms proper of the disease are excessive, and compromise the course of the malady, or because phenomena or complications arise which aggravate the state of the patient.

Therefore, while I find insane the practice of bleeding every pneumonic solely because he has pneumonia, while I am confident that some pneumonics derive undeniable advantage from general blood-letting, also taking into consideration the etiological factors, it appears to me a necessary scientific task to establish, not by means of theoretical ideas, but on the basis of the morphological facts, the difference of the organization of the individuals who derive benefit from the abstraction of blood as compared with that of those who remain indifferent to or receive injury from it.

What I have stated concerning pneumonia applies equally to all the maladies in which blood-letting is advised or not advised, while the statistics, like the theories, have not yet been able to decide the question definitely.

Still, keeping to the example of pneumonia, which is most suitable for our research, one readily sees that in the plethoric individuals the general symptoms have a special character of orgasm—the fever and all the phenomena are more active, more acute ; the fulness of the pulse, arterial hyperæmia, and nervous excitement are not such as are met with in other cases ; and thus also the active hyperæmia of the morbid focus is more intense, more extensive. The expression of the face, flushed and turgid, the fulness of the arteries of the head, hyperæmia of the eyes, intense headache, agitation, insomnia, delirium, sputum stained with blood, and sometimes hæmorrhagic, the acuteness of the stabbing pain, difficult breathing, violent pulsations of the heart, all are phenomena which show that the sufferings in these cases are increased by the exaggeration of some nervous and vascular facts, which are special to the individual morphological condition.

In those cases in which in the healthy state the generic morbid disposition is constituted by the above-mentioned morphological conditions—these, when the disease presents itself, exaggerate their influence. The inflammatory hyperæmia is therefore greater than it would be in different cases, and the same can be said of the circulatory condition of the other parts in general, but above all of those which control the most important functions of the organism.

It is necessary to bear in mind a physiological law which is founded upon clinical experience, and it is this : Those organs, or systems of organs, that in the state of health are singularly weak or singularly excitable, active, and resistant, in the state of disease, with their ready depression or excess of excitability, contribute to aggravate the morbid process. In plethoric subjects the phenomena which aggravate and may compromise the course of the malady are precisely those which I have already mentioned as the expression of the morbid disposition constituted by the special individual morphology; consequently, in this resides the most rational indication for the practice of blood-letting.

It not being necessary on this occasion, owing to the nature of my work, to discuss fully the treatment of pneumonia, I have confined myself to these general facts that, as I have said, I intend to apply to all the diseases in which, together with fever, there are analogous, concomitant, and, I repeat, compromising phenomena.

Returning to my argument, I believe it my duty to show that these phenomena, when they begin to be compromising, must be treated with blood-letting.

Whatsoever be the morbid state—inflammatory or infective—we have always to consider two sides of it on which the special phenomena of plethora manifest themselves: the anatomical focus and the general condition. In the former prevail arterial hyperæmia, the development of the capillaries, the morbid production, and all that which, considered solely from the mechanical side, modifies profoundly the relations in which the trophic vascular system and the absorbent system find themselves; this, by reason of the altered conditions of the internal and external pressure, performs its hydraulic office, consequently that very important of absorption, in a much more difficult way. These relations are the same, and the termination of the morbid process equally depends upon them, whether it be the lung affected by pneumonia, or an intestinal follicle, or a lymphatic gland, or the kidneys attacked by an infective process.

I shall not here discuss the causes of the morbid processes, because if I did so I should have to consider many other circumstances which refer to the very important bacteriological and clinical researches, while my main object is to confine myself to the morphological facts. And it is when reflecting on these, and especially on what I have said above concerning the altered relations of the vascular organs in the part affected, that I must call to mind what the physiologists have shown regarding the necessity that the relations should maintain themselves within certain limits, in order not only that the hydraulic function be not suspended, but also that the phenomenon of metabolism, the nutrition, and the life of the elements, be not compromised.

Not rarely when dealing with clinical matters certain phrases of ordinary experience recur to the mind, which in their almost brutal form contain scientific truths not yet thoroughly explained. One frequently says that certain individuals who are pictures of health—and who appertain for the most part to the Second Morphological Combination—if they fall ill will die. I think this is true owing to the circumstances with which I have been occupying myself, saying that in their morphological conbination they have the elements which cause the disease to reach its greatest gravity.

In fact, just as in the anatomical alterations, so also in the general state, facts are observed which, left to themselves and inadequately appreciated, arise as complications of the disease.

I say this in a general way, without pretending that plethoric patients always meet with the same circumstances. Here, therefore, I feel it my duty to recognize that, in weighing precisely the morbid conditions, the antecedents of the patient have to be taken into serious consideration.

The general state, then, of the plethoric patients, by virtue of the height of the fever, the arterial hyperæmia, and the orgasm of the nervous system, becomes imposing, and aggravates the malady. We desire to mention, however, that these conditions will be grave, very grave, or fatal, according to whether the patient, owing not only to his morphological condition, but also to the nature of his habits, his age, etc., offer us plausible arguments for deciding the question of the treatment.

This is truly a point of clinical pathology that requires special consideration, on which the judgment will be conformable or not to the truth, according to how the anamnesis is made, and according to how it is interpreted. Even starting from the morphological conceptions, from which we obtain the first curative indication for bleeding, it may happen that two physicians are in perfect agreement in recognizing all the particulars which concern the symptomatology proper of the disease, but disagree when that particular physiological factor which indicates the practice of blood-letting has to be taken into consideration, and which emerges only when the influences that the kind of life, the habits, age, etc., together with the disease, have exercised on the organs are carefully estimated.

The case of a plethoric individual who is struck down with an acute disease in the flower of his health, in the absolute fulness of his habits, and, I would say, preferably, of his habitual irregularities, among which is always to be included that of diet, is very different from that of the patient who for some days has been dissuaded from his habits, and obliged to diminish his diet, perhaps also to take some purgative, and so on.

This is so true that we find a different manner of behaviour of plethorics when attacked by a disease like pneumonia, which, as a rule, has not prodromata and typhoid fever, or other malady which has. And even among these latter there are some preceded by such prodromata that they do not interfere with the habits of the patients, and thus explain all the gravity of certain symptoms which indicate the plethoric condition.

He who, being plethoric, has not adjusted his special habits to the most suitable hygiene, ends by acquiring special morbid dispositions, as we have seen. If he be attacked with an acute infirmity, these necessarily reveal themselves, and express themselves as conditions which aggravate and even complicate the disease.

Such conditions manifest themselves especially in the circulatory apparatus ; heart and arteries, that at first present phenomena of the most marked orgasm, subsequently may fall into a state of weakness, and thus derange the equilibrium of the circulatory function, compromising the continuity of existence solely through the fact of the appearance of the complications.

In this connection the remark may be made that by abstracting blood we will only hasten this phase of collapse, and I foresee the cases which might be presented to me in proof of it.

But in medicine there is nothing absolute. That which I say is true, though not absolutely so ; it is not true in respect to the experience derived from the systematic practice of past times, although in this are included cases which support what I maintain; but it is true as regards the conditions which I have described, and which are in reality the root of the question.

It is a fact that, *cœteris paribus*, we may see patients who were considered healthy, but not plethoric, survive an attack of pneumonia, typhoid fever, or smallpox, while others, who were said to be very robust, and who at bottom represented a certain degree of plethora, rendered greater by the habit of eating and drinking too much, had to succumb. And if one was there to assist at the last phases of aggravation and the death-struggle, could one with certainty point out either the grave hyperæmia of the nerve centres or the cardiac paralysis unexpectedly declaring itself in the midst of phenomena complicated by one or another event, others still which denoted the grave circulatory difficulties in all the viscera ?

Therefore, when I maintain that the indication for blood-letting may be given by any disease whatsoever in plethoric patients, I mean that in the concrete case one must take into consideration the following factors : (1) *The degree of the morphological combination ;* (2) *the antecedents of the patient in so far as they may have increased the mortality ;* (3) *the special symptoms of the disease which, becoming excessive, may in their turn contribute to its acquiring an irregular and a more severe course.*

Up to here I have spoken of plethoric subjects in general, and from what I have said it results that I have made allusion especially to arterial plethora. With regard to venous plethora, the therapeutic question of blood-letting presents itself somewhat different.

If we continue to consider the individuals equal to one another, and attribute to them the same morphological value solely because all offer us the characters of venous plethora, we shall readily fall into the systematic error which we have accused the old scholastic theories of.

We, on the contrary, start from the maxim that it is necessary not only to know the kind of morphological combination, but also to determine the species, the individual variety ; consequently, speaking of venous plethora as the special indication for the practice of blood-letting, or of the depletive treatment, we must distinguish the different cases which may present themselves in which, owing to morphological reasons, we see the therapeutic indication modified.

In fact, those who have the anatomical and physiological attributes of venous plethora may offer conditions relative to

(1) the circulatory centre, (2) venous plethora itself ; and these conditions must be noted and separately deliberated upon before deciding what is to be done.

1. The circulatory centre is a term—as I have said in several places of this book—which varies much in different individuals. Inasmuch as in arterial plethora the left ventricle may present itself more or less developed and even hypertrophied, consequently differently active also, owing to the degree of its functional excitability in favouring the morbid symptoms of plethora, thus in venous plethora the form, development, and resistance of the heart may vary ; and therefore render the conditions of venous plethora different in intensity and gravity.[1]

In some of these individuals the heart has considerable resistance ; measured in the different hours of the day during a febrile disease, one sees that it undergoes no modification ; the febrile symptoms comport themselves with a certain uniformity and proportion which reassures one sufficiently as to the general state ; while, on the other hand, the morbid foci show no signs of special intensity, or gravity, or complications due to the circulatory phenomena.

In others, on the contrary, the heart does not possess similar resistance, and one very soon observes some modifications in the area of dulness, owing to dilatation of the right ventricle. With this phenomenon other symptoms appear as complications of the disease, and are referable either to the cerebral centre, or the respiratory apparatus, or the kidneys, and so forth.

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[1] Laennec, who, as we have seen elsewhere in this work, conceived thoughts truly of the highest importance concerning the organic conditions of the heart, speaking of blood-letting, says : " In all the cases in which the pulsations of the heart are proportionately more energetic than those of the arteries, we can abstract blood without hesitation, and be certain of an improvement in the state of the pulse " (*De l'Auscultat.*, t. i., p. 486 *et seq.*). If we pass over the phrases, *in all the cases* and *we can abstract blood*, and stop at the clinical fact mentioned in respect to the disproportion between the pulsations of the heart and those of the arteries, we shall see that it treats of a phenomenon sufficiently frequent, which very often preoccupies seriously the physician, and which, to be rightly interpreted in every case, requires not only the criterion of the function of innervation, but also that of the special morphology of the heart, as I shall endeavour to maintain in the following pages. Here I shall say only that *the most energetic pulsations of the heart* do not refer to the more tumultuous work of the left ventricle, but to that of the right, in those individuals in whom this has originally greater development, and is stimulated to function excessively in those moments in which the venous stasis is elaborated, and it enlarges, strikes extensively and firmly the chest-wall, and, in spite of this exaggerated function, the pulsation of the arteries is lowered. The word " pulsation " employed by Laennec is not the most appropriate, as we shall see hereafter ; but the observation is very valuable.

In the former case, notwithstanding the existence of the venous plethora, no one certainly would wish to bleed. In the latter, when the foregoing complicative circulatory facts begin to make their appearance, a therapeutic precept quickly occurs to the mind —namely, that of possibly relieving the venous hyperæmia which is forming here and there, a hyperæmia which must naturally be considered injurious for the following reasons : (1) Because, establishing itself in the morbid foci, it interferes with the development of the nutrient phenomena, aggravating the alteration in course ; (2) because, giving rise to stasis more or less vast in other organs, apart from the morbid focus, it creates functional difficulties either respiratory, or nervous, or secretory, with still greater damage to the whole organism ; (3) because the accumulation of an abnormal amount of blood in the venous system greatly lessens the endarterial pressure, with the consequence of other damages derived from the diminished arterial supply in the organs.

Therefore the first thought that strikes one in the presence of these facts is that of preventing, if possible, the complicative venous congestions.

How can this be done ?

The usual custom is to prescribe a stimulating cardiac treatment ; the action of the heart is supported by the drugs which experience has shown to be most useful. But the conditions may or may not be favourable for such treatment. In either case the physician believes that he has done his best, and does not think further about it.

And I firmly believe that, proceeding in this way, the best will be done in many cases, but not in all. I know that whenever I am prepared to adopt this treatment, following the example of the majority of physicians, I am always assailed by a doubt, and I ask myself : But the heart, knowing the particular conditions of its morphology, is it capable of combating the functional impediments produced by the disease ? Will the cardiac stimulants alone really satisfy all the possible indications ? Can we positively deny that the stimulating remedies would act, or act better, if aided by some circulatory expedient ?

Here, I believe, resides the most important point of the question. When in these individuals we meet with phenomena of cardiac weakness, this may be depending upon the following causes: (1) Nervous causes, either relative to cerebral influence, or to a possible functional alteration of the cardiac nerves; (2) mechanical causes inherent to the physical function of the heart muscle, which does not correspond to the natural and artificial nervous excitation.

In the first of these cases the effects of the treatment, by means of the most efficacious drugs, correspond, as a rule, so long as the excitability of the nervous system lasts. This may be extinguished by the influence of the malady. But the effect of the excitability—which, persisting, may be verified wholly or in part by other physiological indications—may be also impeded solely because the myocardium is strongly distended by the internal pressure, and has had to succumb, so to speak, to the extraordinary mechanical movement, for by its primitive morphological state it was not endowed with greater resistance, and therefore has fallen more quickly into distrophic conditions. Experience proves this to us every time that, during the course of acute diseases, we see the myocardium enormously distended, especially in its right half, or with signs of granulo-fatty degeneration. It is necessary to record this, because it demonstrates the reality of the fact which I have mentioned—namely, that there may be anatomical conditions of the heart which do not correspond to the requirements of the moment, and such that they cannot be modified, solely soliciting, even with the greatest energy, the co-operation of the nervous system.

These are the conditions which we must now study more fully from the morphological point of view. The individuals with venous plethora generally have the right heart more developed than the left heart; but these circumstances can be of different degree. Let us consider, according to experience, the two extremes of the series of cases: in the one extreme we see an individual with venous plethora, and the heart as a whole well developed, and sometimes more developed than normal; in the other we see an individual who also has venous plethora, but with a heart which barely possesses the necessary proportion. On more carefully examining the heart of the two extreme cases, we note that in the former the left ventricle is fairly active, strong, and resistant, though the right is in proportion more ample; while in the latter the left ventricle is in proportion much less vigorous and still smaller in respect to the right ventricle.

If these two extremes of the series be attacked by an acute disease, such as pneumonia or an infective fever, they will present different circulatory phenomena, different indications, different resistance.

The mass of the heart is more valid in one, less in the other. In the former, with the cardiac dulness absolutely larger, there is greater resistance. If owing to deficiency of nervous excitation complicative blood stasis be constituted, we can have recourse to direct abstraction, because the physiological resources are not wanting in the heart; because the minor disproportion which exists between the two ventricles permits its greater functional harmony. In the latter the heart is less resistant; in it the abstraction of blood may be the cause of grave arterial ischæmia, with all its consequences. The stimulating treatment associated with indirect depletions will give better results.

During the time of the medical phlebotomists—and some are met with even in our days—blood-letting was employed in every disease, in every person. And in the midst of the multitude of therapeutic results arguments were found for supporting and for combating the use of bleeding. On both sides the signification of the facts taken into consideration was exaggerated. The question was never carried into the true scientific field, where one finds arguments for the interpretation of the facts for conceiving the rational indication for or against blood-letting.

I have been a blood-letter through the will of others when I was admitted to hospital practice during my career as a student in the hospital of S. Matteo at Pavia, and after laureation in the Ospitale Maggiore of Milan. It was the time of the reform of the old medicine, as we Italians then called it, and I felt all the holy horror which the abolitionist theories had inspired in me against the common practice of bleeding. As I have said in the first page of this book, directly I was let loose from the scholastic fetters I began on my own initiative the critical study of the facts, and since I was obliged by duty to bleed on a vast scale, I decided to examine the facts, to compare them, to draw conclusions from them, which, though they were insufficient for supporting or combating a theory, enabled me to set problems which appeared to me worthy of study, and which were the point of departure of my investigations in the field of morphology.

And remembering the facts and the impressions which I then received, and the discussions which I had with one of my colleagues, I became more and more convinced that in the course of time, and with the progress of the science, many old things would become new, and that that which seemed proved would again be the object of new investigations. When, through my having had to bleed a patient, I thought that I had committed a crime, and afterwards, contrary to my expectation, I noted a succession of things which had to be considered reassuring, I used to repeat to myself the refrain : "And yet the question of blood-letting must be reconsidered under a new order of scientific conceptions." And when, in spite of the bleeding, or owing to it, the patient grew worse, the conviction became strengthened in me that the less practical medicine proved to be practical the more it required the support of systematic conceptions, as generally happens, and as is deduced especially from what those pretend who say that medicine is not a useful science, because one does not know whether that which is useful in one case will be useful in another.

Nevertheless, the scientific character of medicine reveals itself precisely in this—in knowing that the therapeutic indications emanate from the special individual conditions, and therefore there cannot be systematic treatments of a special kind, when one has to deal, not with the specific treatment—such as that, for instance, of syphilis—but with the rational treatment employed against the symptoms and the most important physiological factors which constitute the mechanism of the whole morbid process.

I have seen patients who, after repeated bleedings, remained exhausted without showing the least sign of improvement ; and I have seen others in whom, after blood-letting, the general febrile symptoms were mitigated in a marked way ; others who presented absolute improvement in the conditions of the morbid focus by virtue of the diminution of the congestion or of the hastening of the resolution ; others, finally, who remained almost indifferent to the treatment. In the early days of my career, when I was a subordinate, I bled many patients suffering from typhoid fever, noting all the changes which subsequently took place in the blood-mass abstracted and in the course of the symptoms. I have never been able to convince myself that the blood-letting had shortened the course of the disease. In some cases, however, I observed that some symptoms after bleeding were mitigated; that in others, in spite of this treatment, all proceeded with such a regularity of morbid phenomena as to justify up to a certain point the presumptions of him who ordered me with the conviction of the systematic phlebotomist of persisting in the *antiphlogistic treatment.* In a young man I remember having made twenty-one bleedings—I repeat *twenty-one*—during an attack of typhoid fever, from which he got well, like many others. I need hardly say that all these patients had constitutional characters more or less marked of robustness or of plethora.

And it is precisely when I remember the useful and injurious effects of bleeding, and, having become more conscious of many things referable to the science and practice, comment upon them, I have always to convince myself that, besides the general indication which may be obtained from the physiological examination of the heart, there is another indication which we must obtain by considering the venous plethora in its individual form.

2. The development of venous plethora is not equal in every individual. In some it may be developed, and visible more or less uniformly in every part of the organism; in others it is observed or may manifest itself more in the superior parts—the head, thorax, or abdomen; in others still it is almost exclusively met with in the thorax or in the belly.

The full importance of these facts will be understood only when one recognizes that in these cases the indications for general or local bleeding are derived not from the general plethora, but from the local venous plethora.

In these cases, as I have said elsewhere, we have to do with the morphological types which appertain as much to the Second as to the First Morphological Combination, because if the local venous plethora can be more specially developed in this or that part of the body in individuals who belong to the Second Morphological Combination, we see it as an anatomical peculiarity and as the basis of special morbidity in some individuals of the First Combination, in whom, at a given period of life, we meet with this disposition of the vascular system predominating in the respiratory apparatus, and in another more advanced period of life in the abdominal cavity. I shall deal more fully with these conditions in another place.

Having seen that the indication for general and local blood-letting is obtained from the special organization—that is to say, the special morphological condition of the patient—rather than from the disease, the practical question is therefore completely displaced from the field on which it has remained up to now, and on which have been fought continuous and strange battles from the most remote epoch of medicine till our day.

In fact, when the indications for blood-letting were expounded, the inflammations first of all were mentioned, then fevers in general, and especially some fevers, and the alterations which were attributed to a special condition of nervous irritability; then were indicated the inflammations of the serous membranes (arachnitis, pleuritis, pericarditis, peritonitis, etc.); inflammations of the parenchymatous organs (pneumonitis, cerebritis, hepatitis, splenitis, etc.); cerebral apoplexy, acute dilirium in general, and *dilirium tremens* in particular; some infective fevers of a sthenic character, hæmoptysis, heart affections, and so on.

One comprehends readily that every morbid case can be, so to speak, the bone of contention if, either by virtue of inflammation, or fever, or a complex symptomatology of an irritative nervous character, one had to discuss anew the question of blood-letting.

If, on the other hand, we start from the individual morphological conception; if we verify that, owing to the special organization of the whole organism or of some of its parts, morbid facts inherent to the circulatory function, which aggravate the morbid process, declare themselves, and even compromise its favourable exit, we enter into a new order of ideas, both as regards the indication and the method with which one must satisfy it. Having thoroughly considered the phenomena, and discovered the indication for a treatment directed to remove the exuberant and dangerous condition, one thinks first of all of the different means of which the art disposes. According to the cases, we may or may not have urgent indications, therefore in the selection of the means we will follow the criterion of the opportunities. The special indication for bleeding in the concrete case may consequently be different; the abstraction may be direct or indirect, general or local.

It is known that to-day there is a reaction in favour of blood-letting. The majority propose it for the purpose of symptomatic treatment, and it has also been proposed for the purpose of treating disease.[1] But I pause for a moment to ask if the symptoms which in different maladies may declare themselves as the indication for bleeding are well determined. So far as I know, no one has reached this point of clinical determinism. It is probable that empiricism alone, instead of new scientific conceptions, has led them to try again the proof of blood-letting, while for explaining its results they have recourse *hypothetically* to one or other of the dominating theories or of those most discussed.

But things being thus, it appears to me that it would be better to try the proof on the guide of new but positive conceptions—scientific conceptions obtained by medicine from morphology—otherwise we shall fall again into the discussions of past times, and if we will not be guided by better scientific conceptions, we shall have to return to the statistics . . . and retake the old path without advantage. Keeping to the guide of morphology, I shall explain an idea which many have expressed almost by way of conclusion after the numerous and heated discussions on bleeding, and it is that, being unable to deny that it is advantageous when practised under the best indications, this is necessary to search for these in every particular case. It will be then by studying its effects that we shall be able to comprehend and verify whether it is the *irritative* element, or the *toxic element*, or other element which acts in the complex phenomenon. It is evident, therefore, that all rests in searching for the indications where they exist, and if they be sought in every concrete case, it is clear that a new path for research will be opened by the criterion of morphology, from which one apprehends that in the special morphological combination of the individual resides the reason of his morbidity, of the different mode of presentation of the symptoms, besides the different curative indication. This has never been sufficiently appreciated, for up to now it has never been professed as a theory of biological science applied to clinical observation, with criteria and rules suggested by experience.

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[1] Professor Maragliano, at the first Congress of Internal Medicine (October, 1888), placed the question as follows: *The mechanical conditions which may disturb in a pneumonic the cardiac function are not sufficient to explain the acinesia of the heart, by reason of which in pneumonic patients it is necessary to refer to some other etiological factor.* He admits *the presence in the blood of pneumonics of some principle toxic for the heart,* and for restoring the cardiac action proposes the application of blood-letting. This, therefore, would have two scopes—one completely mechanical, the other that of *favouring the elimination of the circulating infective materials.*

Professor Cardarelli, while admitting in pneumonies a principle toxic for the heart, directed attention to another fact—the slight resistance the heart may originally have. I myself in my turn, without denying importance to the toxic principle in contributing to the cardiac acinesia, endeavoured to show that the knowledge of the morphological condition of the heart must also be taken into consideration in the indication for blood-letting, explaining by means of my observations on this subject what Cardarelli had asserted by happy clinical intuition.

Reading again the Transactions of that Congress after some years, I still hold to the facts and considerations which I have expounded.

I have said that blood-letting has also been proposed for the purpose of treating the cause which in some diseases gives rise to many functional anomalies. This is a grave argument into which I am unable to enter, because I do not possess observations expressly conducted. I shall simply observe that this conception may lead to a systematic practice. If the disease give rise to a particular state of blood-*toxæmia*, which must be considered injurious to the whole organism, and especially to the function at first, then to the nutrition of the nerve centres, and from this intoxication are derived definite symptoms (which should not be allowed to increase to such a degree as to threaten life), one will be very desirous to combat these symptoms directly they manifest themselves. Consequently, the employment of blood-letting, rendered in this way rational in these cases, will extend beyond the limits which have been scrupulously respected up till now. With these conceptions one loses sight of the individuality, but we shall find ourselves not rarely confronted by embarrassing questions.

But has it been demonstrated in a positive way that the symptomatology is produced exclusively by the toxic condition of the blood ? Has it been disproved that its origin may also be due to the special morphological conditions of the patient ? And can it be considered as proved that when a certain amount of toxic blood has been abstracted the rest has acquired less toxic properties, the morbid process continuing—that is to say, the final preparation of the toxic substance ? Must it be completely ignored that in some individuals the abstraction of blood is contra-indicated ? Can one really attribute to the abstraction of blood, therefore to the removal of toxic substances, that improvement which is observed, and which may also be ascribed to the improved condition of the hæmodynamics ?

I cannot deny, nor do I wish to do so, that in the blood is found a toxic principle, that this helps to produce the symptomatology which one desires to treat by means of blood-letting. But from what I have said above the doubt assails me that the advantage obtained by bleeding practised with the idea of excluding from the blood-mass a certain degree of toxicity can be explained also, and perhaps better, by the fact that, by means of the abstraction of blood, a circulatory incumbrance has been removed. This renders great service to the heart which has been subjected to the weight of an excessive internal pressure, and consequently weakened in its action, if one desire, also by toxic effect, serves less to the scope of the hæmodynamics—that is, of the function which requires to be the best sustained in order that the introduction of a sufficient amount of oxygen and all the biochemical work which depends on it should continue.

Although I have expressed a doubt, I do not intend to confute the question under consideration, because to confute or to sustain a question of this importance would require a large material of observation.

For me, then, the indication for the abstractive treatment is given by the presence of definite symptoms, which by reason of their importance require a special treatment, and in their pathogenesis reveal the particular morphological condition both in acute and chronic diseases.

The particular morphological condition to which I allude is that which passes under the name of plethora.

According to the kind of plethora, according to the corresponding morphological condition of the heart, according to the gravity of the symptoms which depend upon it, and according to the necessity or not of having to urgently provide, the abstractive treatment can be effected in different ways—direct, indirect, general, or local.

During an acute malady general arterial and general venous plethora may indicate the direct abstraction by means of blood-letting when the excessive orgasm of the febrile phenomena and the arterial hyperæmia of some parts—the brain, for example—or when the grave venous hyperæmia of others—the lungs, abdominal viscera, for example—compromise the regular course of the morbid process, and give rise to dangerous complications.

They also, during chronic diseases, may indicate the direct abstractive treatment when on them depend the persistence or the aggravation of certain symptoms—for instance, in the early phases of a heart disease, of aneurism of the aorta. When the danger of greater gravity has passed, one must maintain the organism in a condition of hydraulic equilibrium, not only with the ordinary means directed to support the circulatory organs when necessary, but also with the indirect abstractive treatment, which, according to the indications, will consist in an appropriate dietetic method, and stimulating the intestinal and urinary secretions.

Thoracic and abdominal venous plethora in acute and chronic diseases may indicate the general direct abstraction or the local direct abstraction. In the case of hæmoptysis in an individual in whom the morphological investigation has shown the existence of a certain degree of aplasia of the left heart and of the arterial system, and an excess of hydraulic pressure in the dominion of the pulmonary artery, and, further, that chronic destructive lesions of the lungs do not exist, and the hæmoptysis presents itself in conditions of what may be called good health, one has the indication for an abstractive treatment.[1] In the case of habitual intestinal alterations with engorgement of the liver, and that ensemble of

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[1] On the basis of my experience, I add that when this indication exists, the patient has almost a florid appearance, or at least that of health, an appetite generally excessive, and is free from certain premonitory symptoms of pulmonary disease. The blood-letting which is performed for treating a first dangerous hæmoptysis may be absolutely effective, and in this case the conditions of the patient gradually improve if subsidized by the most appropriate hygiene. It may be useful in a relative way; the hæmoptysis may recur. In this case I do not believe in following the criterion of the special morphology of the patient, because contra-indications arise on the part of the general state and by the appearance of pulmonary lesions which certainly one will not treat with blood-letting. I can recall cases in which the repetition of the hæmoptysis, even when abundant, instead of having been followed by the anatomical and general phenomena of lung disease, was followed by the progressive improvement of the alterations previously verified, and by the unexpected cure.

I have very frequently met with patients suffering from abdominal diseases, in whom existed similar therapeutic indications, but which did not satisfy the medical attendant, owing to the belief that they would have injured the patients. Well, it was sufficient to do what the symptoms indicated to see the patients quickly improve. But is it possible that damage is produced removing the difficulties to the exercise of the digestive functions and of the secretory functions, removing the hepatic stasis which damages the functions of the stomach, which affects the whole organism, which embarrasses the renal function? I can maintain, and I have demonstrated, that making the abstractive treatment in certain cases improves the blood-erasis instead of damaging it. Here it is sufficient for me to state that in some patients suffering from abdominal scrofulosis, and made the object of special study, after the application of leeches to the anus, for the purpose of modifying the circulatory condition of the abdomen, phenomena which is called "hæmorrhoidal sufferings"—with or without external piles—we find the indication for the local direct and indirect abstractive treatment. When in a chronic disease of the heart abdominal plethora prevails, or declares itself as complicative symptoms, here we have likewise the indication for the local direct and indirect abstraction. The former removes the greater symptomatic difficulty; the latter aims at maintaining in due proportions the endovascular pressure. Further, there are cases in which the indirect abstraction alone performed according to the just physiological criterion is sufficient for the purpose. In certain cases of abdominal scrufulosis in individuals in whom, by means of morphological researches, we see abdominal plethora prevail the local direct abstraction is also useful.[1] If with the indications obtained from the morphology we consider many cases of hepatic cirrhosis in its first stage (which I willingly call, with others, "precirrhotic," to use an expression more appropriate to the facts); if we consider many grave disturbances which some gravidæ suffer from; or certain aggravating facts of abdominal plethora in some maladies of the central nervous system, we shall see arise the indication for the direct abstractive treatment, and from its suitable application we shall understand still better the importance of the morphological views in the clinical field.

As results from what I have said up till now, I have undertaken to treat of blood-letting, not for studying systematically its influence on the circulation, and the many phenomena which concern it, nor its influence on the thermogenesis, the nervous system, secretions, etc., but solely for trying to demonstrate that the indication for bleeding and its substitutes must be regarded from a new point of view. It is natural that when we see its indication in the concrete case, we must also profit by the well-

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I saw repeatedly the hæmoglobin increase, while the local morbid conditions improved. I have also entrusted the research to others ignorant of the fact revealed by me, in order to have undoubted results, and they were not different from mine.

[1] This also is the fruit of my experience (see *Commentari di clinica medica*, vol. i., pub. Draghi, Padua, 1889), and I can attest that when the therapeutic indication has been well interpreted, the advantage derived from it by the patient is undoubted. I have had no few verbal relations and some written communications with medical practitioners who have employed my method of treatment, from which I have obtained the confirmation of my conceptions of the pathogenesis and treatment. Certainly I do not intend that all the cases indistinctly and at whatsoever stage of the malady offer the same indications.

ascertained notions which physiological experiment and clinical experience have collected to enable us in the most rational mode to weigh all the effects which may follow the therapeutic method in question.

I have spoken of the therapeutic indications for the different forms of plethora, but nothing of those regarding serous plethora. Not wishing to repeat what I have already said concerning its mode of presentation, I shall simply add that, when it exists, it expresses the effects of a relative venous plethora, of which it may be well considered a modification, owing to the indications which I have described elsewhere; that when it exists as a true dyscrasia in individuals who have been ill for a long time, and are endowed with the morphological attributes special to venous plethora, the treatment must be indirect. It is necessary, on the one hand, to stimulate the loss of water, on the other, to favour the introduction of nitrogenous elements and their assimilation. It is certain that also in these cases the indirect abstraction—when the digestive organs can be utilized for the consumption of the diet just mentioned—is better than any other for relieving the state of the circulation, especially in those parts of the organism which feel the plethoric condition in the highest degree.

My experience of the practice of blood-letting in this connection has been so very limited that I cannot speak definitely about it. I can only refer to some isolated cases. On one occasion I was summoned to see a gentleman in a very grave state, and he who accompanied me blamed the medical attendant, who was a noted blood-letter, for having bled the patient. The patient presented a true type of venous plethora modified by dyscrasia, due to chronic cardiac troubles, consequently serous plethora; the internal and external œdemata were enormous. The medical attendant told me that, owing to the symptoms of suffocation of the patient, he had been obliged to open the vein, and abstracted half a basin of blood, with little curor and a thin layer of buff. After the venesection, the respiratory difficulties, cold sweats, cyanosis of the face, and coldness of the extremities disappeared. The patient had stenosis of the aortic orifice and insufficiency of the semilunar valves, hypertrophy and dilatation of the left ventricle. I was firmly convinced that though the bleeding had removed the imminent danger, this would be quickly renewed; but instead, the kidneys began to act freely, the œdemata to disappear, and the cardial function to improve, so that after some time the patient was able to leave his bed.

Another case I treated in my clinic. It was that of a Custom-House officer, who suffered from an organic affection of the heart. He was an old acquaintance of the clinic, and his case had been diagnosticated by the late Professor Pinali, later by his successor, Professor Concato, and finally by me. The diagnosis was always the same—insufficiency of the aortic valves. I verified the successive increase of the cardiac affection by reason of the incipient dilatation of the left ventricle, and consequently defect of its function; however, I admitted him many times into the clinic, and as many times he was dismissed, improved to the extent that he could perform his duties to a certain degree. The last time he entered his condition was so alarming that there seemed to be little hope for him. While he was under the treatment, which, though indicated, proved inefficacious, he was seized with exquisite stenocardiac attacks. No means succeeded in preventing them. One day he was about to cut his throat with a razor, because he said we had no remedies for relieving him from his extreme sufferings. Then I ordered blood-letting, and I remember having made the following considerations: "The patient, indeed, has a morphological type, which induced me at other times to persist in the local direct and indirect abstractive treatment; besides, bleeding is advised in angina pectoris. We have grave dyscratic conditions, but in any case the patient is about to die." Having bled him, the stenocardiac attacks ceased to make their appearance, the œdemata diminished, and the patient was again able to leave the clinic. Four years later, if I am not mistaken, the patient permanently retired from his employment, and living in his native place (Friuli), grateful for the benefit received, came to see me, in order that I might observe the final result of the treatment. In these four years he had not had a stenocardiac attack; his general nutrition had improved, and he had lived fairly content with his physical condition. Since then I have not seen the patient.

I certainly do not intend to dogmatize in a systematic way regarding the application of blood-letting, but I have become more and more convinced that in those patients in whom by virtue of their special morphological conditions, grave symptoms manifest themselves, in spite of the dyscratic conditions, we may find the indication for blood-letting.

IV. Third Morphological Combination.

This Combination is rather frequent in infancy, less frequent in adult age. It is distinguished by the fact of the enormous disproportion in the development of the two cavities—thorax and abdomen—this being extremely big.

One will understand why this Combination is rather frequent in infancy, and less so in adult age, when one remembers that the organism, better developing from year to year, becomes modified. And in the majority of cases the modification occurs precisely through the enlargement of the thoracic cavity.

Apparently I have no right even to speak of a Third Morphological Combination, for in the above statement one recognizes the fundamental character of the First Combination, in which we likewise see the irregular types, with the small chest and big belly, and their possible transformation.

Besides the primary fundamental morphological character, a certain affinity, which we shall see in the morbidities common to the types of both combinations, would also seem opposed to the intention of treating expressly of the Third Combination.

Nevertheless, we must mention at once that the individuals who appertain to the Third Combination, and are distinguished by the exceptional development of the abdomen, may have a small chest as well as a big one.

But it may in like manner be said that, instead of speaking of a Third Combination, it would have been better to refer ourselves to what has been said of the Second Combination, when the individuals present its characters, and that it would have been better to refer ourselves to what has been said regarding the First Combination, when the fundamental morphological characters permit it.

Well, in order not to make repetitions, I shall act precisely in this way every time that the case requires it ; but it is necessary to show that there are individuals who are distinguished from all others by an exceptional development of the abdominal cavity. And whether they can be referred, owing to their primary fundamental characters, to the First or to the Second Combination, they present in the exceptional development of some parts, and especially of the belly, and in the general adaptation of the organism, some special morbidities of which it is necessary to speak in a particular way.

Moreover, for showing the necessity of treating expressly of the Third Morphological Combination, I would add that, having had occasion to discuss a morbid condition which I had studied in individuals belonging to the Third Combination that we shall presently know, and wishing to present and describe the facts in such a mode as to impress him who was still unaware of my studies in this connection, I confined myself to revealing the morphological fact in a synthetic manner with a simile. Thus, one day I showed my students a boy whose morphological particulars I had minutely studied, and whose body resembled that of the batrachia—thorax extremely short, belly very big, and extremities very long. At another time I compared the body of an adult to that of the gorilla—thorax big, and belly much more bulky than the latter. This simile is useful as a preamble for impressing the mind with a new fact, whose details it is necessary to know.

Every physician who is an observer, reading these words, will recall individuals who must have made an impression on him, owing to these singular forms of the body, even if he has not made a special study of them. And if now he understands exactly the importance which the form of the body may have, both from an anthropological and a physio-pathological point of view, he will equally understand my conception—that is to say, that of indicating these individuals almost as monstrosities of the species.

But without stopping to consider these exceptional types, which by virtue of their extreme degree of morphological anomaly can be considered as the extremes of two different series of individuals belonging to the Third Combination, the peculiarities of the facts will be more clearly demonstrated, representing them as I have generally seen them, and have reproduced, by means of the four following figures : A minute examination is not necessary, inasmuch as a glance is sufficient to reveal the morphological characters special to each individual—Fig. I. represents an individual who approximates to the ideal type ; Fig. II., a variety of the First Combination ; Fig. III., an example of the Second Combination ; Fig. IV., an example of the Third Combination.

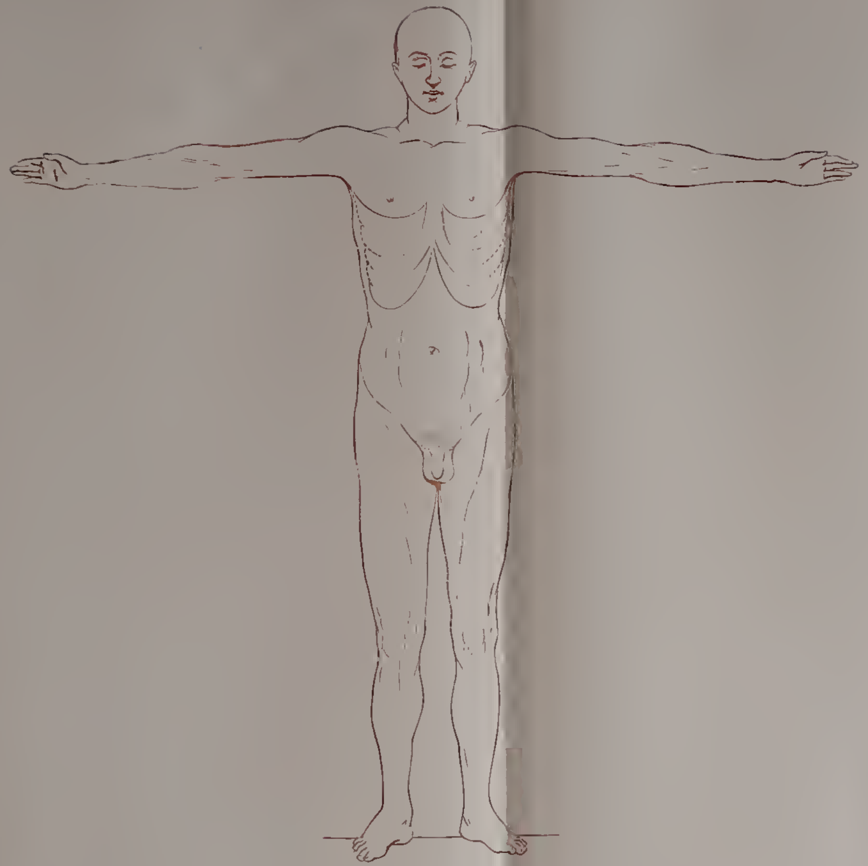

Fig. I.

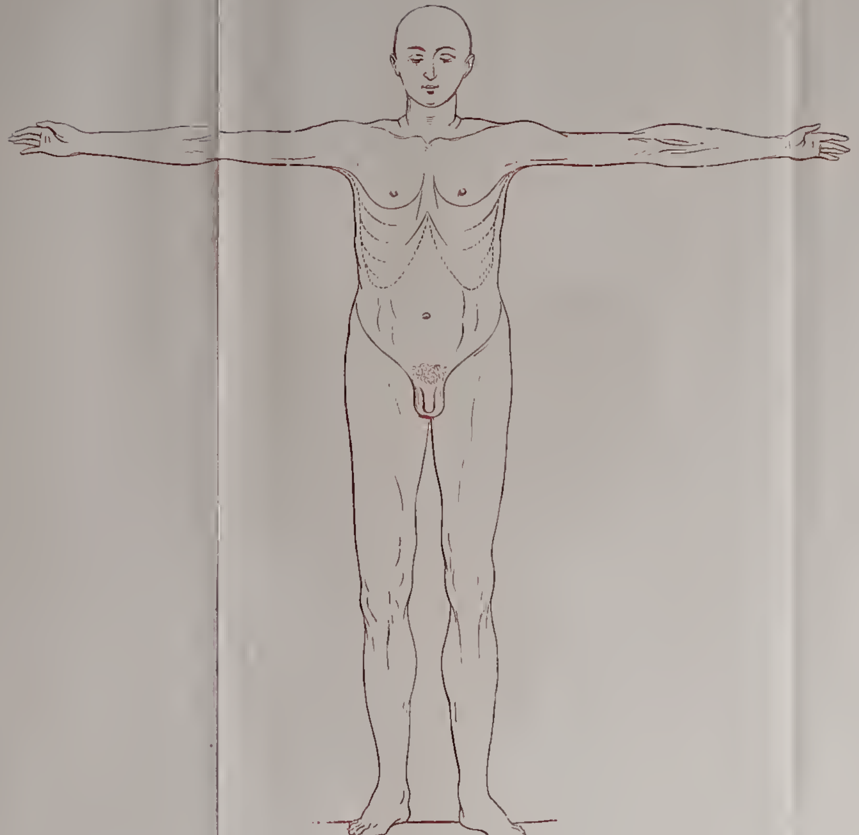

Fig. II.

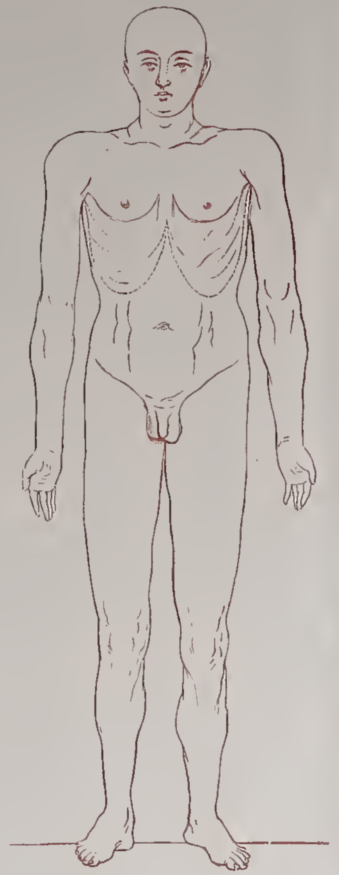

Fig. III.

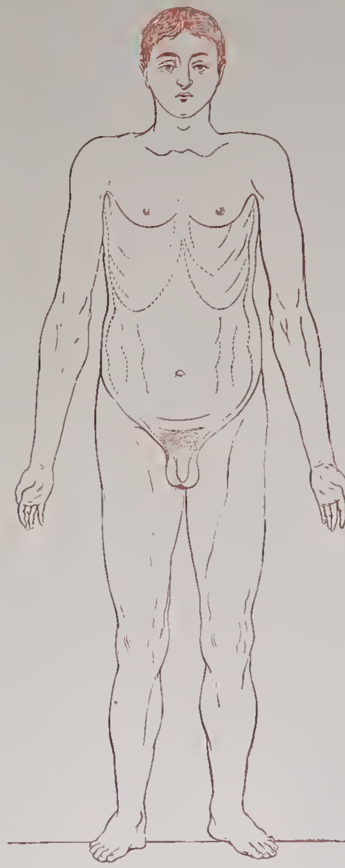

Fig. IV.

To face p. 354.

Having made this brief review on the different types of morphological combination, we shall now consider Figs. III. and IV.

I note that with the scope of expressing graphically the most important things, and at the same time a large number of particulars, I have compared two individuals of the same height, but one (Fig. III.) pertaining to the Second Morphological Combination, the other (Fig. IV.) to the Third, with which we are dealing. After a minute examination of the figures, the reader can with advantage compare them with the first two, which represent two individuals, also of the same height, but with different development of the cavities, and by the comparison thus instituted he will be convinced of the things said regarding the existence of the Third Morphological Combination.

I have inserted the figures in this place, because, describing the Third Combination, one must refer to the different variety of types, this combination having very frequently associated with it characters appertaining to the others.

The example offered us by Fig. IV. is absolutely exceptional, and we can recognize in it markedly monstrous forms, which we shall still better appreciate if we compare the relations of development of the thorax and of the abdomen with the personal height.

In fact, this being in both individuals 1·65 metres, according to the rule, the other parts ought to have the following proportions :

	Centimetres.
Thoracic circumference	82·5
Sternal length	16·5
Abdominal length	33·0
Bi-iliac diameter	26·4

We have instead :

	In Case III.	In Case IV.
Thoracic circumference	88	86
Sternal length	16	21
Abdominal length	35	40
Bi-iliac diameter	31	32

Therefore in the two individuals one has—the thorax absolutely bigger than normal, the abdomen the same ; but in Case IV. the abdomen reaches still greater proportions, both as regards its length and bi-iliac diameter. If Case III. represents an individual of the Second Combination modified by the maximum development of the belly, Case IV. exceeds this extreme, and constitutes a term of another series of organisms.

I do not pretend, as the reader will already have understood from what has gone before, to distinguish human bodies into categories to which must precisely correspond definite morphological combinations. Every attempt at a classification, however severe, would find insuperable difficulties in the law of individual variation. Therefore, dealing now with a Third Morphological Combination, I wish simply to show that there are individuals in whom the development of the abdominal cavity, through being exceptional, lends itself to instituting investigations—physio-pathological observations which in part support the foregoing facts, in part direct us to others, as we shall see.

Meanwhile I give two other singular examples in the following table, with the figures opposite each which they ought to have relatively to the stature according to the rule. The first represents a girl of seventeen years, the second a boy of nine.

	I.		II.	
Stature	135	According to rule	126	According to rule
Thoracic circumference	58	67·5	69·5	63
Sternal length	12	13·5	11·5	12·6
Abdominal length	33	27	32	25·2
Bi iliac diameter	20	21	19	20

Here, also, the difference between the abdominal length according to the rule and that which these individuals had is very notable.

But these two as well as the second of the preceding must be considered owing to the value of another morphological particular—that is to say, the great prevalence of the xipho-umbilical line, as is seen in the following table :

$$1.\ \text{Centimetres } 40 \left\{\begin{array}{l} Xu.\ \ 32 \\ \cdots\cdots\cdots\cdots \\ Up.\ \ \ \ 8 \end{array}\right. \text{ instead of } 33 \left\{\begin{array}{l} 16{\cdot}5 \\ \\ 16{\cdot}5 \end{array}\right.$$

$$2.\ \text{Centimetres } 33 \left\{\begin{array}{l} Xu.\ \ 23 \\ \cdots\cdots\cdots\cdots \\ Up.\ \ 10 \end{array}\right. \text{ instead of } 27 \left\{\begin{array}{l} 13{\cdot}5 \\ \\ 13{\cdot}5 \end{array}\right.$$

$$3.\ \text{Centimetres } 32 \left\{\begin{array}{l} Xu.\ \ 24 \\ \cdots\cdots\cdots\cdots \\ Up.\ \ \ \ 8 \end{array}\right. \text{ instead of } 25{\cdot}2 \left\{\begin{array}{l} 12{\cdot}6 \\ \\ 12{\cdot}6 \end{array}\right.$$

In each of these cases the line *Xu* reaches double the length it ought to have according to the rule.

Finally, we shall mention another fact which, in like manner, helps to characterize this category of individuals—namely, that the size of the belly is excessive by virtue of its length alone, even when the bi-iliac diameter is relatively or absolutely less developed.

Having explained these facts, which I hope are sufficient for giving a clear idea of the special Morphological Combination, I shall now proceed to speak about the physio-pathological particulars.

In order to understand better why the prevailing morphological character of the adult's morbidity depends upon the excessive development of his belly, it is necessary to start from the age of infancy.

At this period the individuals can be roughly divided into two orders. Although they have in common excessive development of the abdomen, they differ more or less in every other respect.

Those belonging to one order are, as a rule, fairly nourished and fat, consequently they present the undeniable aspect of florid health. It is for this reason that, although sometimes the disproportionate size of the belly makes an impression, their morphological condition passes unnoticed, because no sufferings present themselves, and the abnormal signification of the special nutrition is not investigated. Yet from time to time important morbid manifestations are not wanting, which attract attention to the abnormal constitutional conditions, but they are slight or transient. Well, if they are slight they are assiduous ; if transient, they are frequently repeated, and in this way denote the abnormal constitution that apparently misleads both the practitioners and the laity, and makes them say that those mild and transient lesions which are met with proceed from one or another imaginary cause, or from external causes, that are mere coincidences, or perhaps simple occasional causes.

In reality these infants have frequent digestive disorders. Later, as children, they eat disproportionately ; the bowels are irregular ; they suffer from recurrent diarrhœa, which may not affect the general state.

Those pertaining to the other order, on the contrary, never present the degree of nutrition of the former : they are much more subject than these to intestinal disturbances which are more intense and lasting. According to their social state, consequently to the hygiene and to the susceptibility of the general innervation, the abdominal phenomena are accompanied by general symptoms of different nature; hence the morbid state more formally declares itself, and for these individuals the anamnesis of the future maladies always begins from infancy.

It is also a notable fact which results from my experience that the things just described may be met with in individuals of every social class; but if they are met with during early or late infancy, or during childhood and the early days of puberty, the primary valetudinarian condition is interrupted by the appearance of some morbid condition or other; then it is that the individuals belonging to the poorer classes suffer most.

And the infirmities which manifest themselves, as a rule, in these individuals are, besides intestinal catarrh, those which in a general way are called abdominal lymphatism, which may have for their anatomical substratum either the peritoneum, or the liver, or the spleen, or even the kidneys, though these are more frequently affected together with one of the organs just recorded.

I do not intend to speak here of the scrofulous forms of the peritoneum and of the annexed glands, because I have done so elsewhere, and, besides, it is a disease to whose pathogenesis and symptomatological interpretation I have little to add, and this I shall do later on, when I apply the morphological conceptions to their treatment. Here I shall simply recall what I have said concerning the criteria which enable us to form an idea of the greater or less development of the intestine and of the mesentery, for when the latter is abundant, it represents the morbid predisposition to the diseases that most frequently have their seat in the elements which constitute it.

With regard to the spleen, I shall simply state that it is an indication of abdominal lymphatism when it is larger than normal and presents oscillations of size which are in relationship with other symptoms connected with the organism in general as well as with the abdomen. In some cases it, above all, denotes the special morbidity of the patients, and its abnormal enlargement must be considered not only as a fact secondary to the morbid form, but also, and especially, as depending upon, owing to its special morbidity, its primitive morphological constitution, by reason of which its lymphatic elements are abundant and vulnerable.

In such cases I consider it as a lymphatic gland. Sometimes, as I have mentioned, the spleen alone is affected, but not in a very pronounced way. At other times it is more pronounced, and its importance increases, and whether or not it accompanies similar affections of the peritoneum or of the liver, it so influences the general state that it leads to more or less profound dyscrasia.

The spleen may present from infancy a size greater than normal, not only in those individuals with an exceptionally developed belly, but also in those in whom the latter is slightly enlarged. This escapes attention, unless the occurrence of some malady of an infective character causes one to examine it. Then it is found enlarged, and the enlargement is thought to be due to the infective process. But it is clear that it must not be attributed altogether to the latter. This is so true that if we compare individuals of the same age and, if possible, in the same morbid condition, we do not obtain the same results from the examination : one finds its volume normal in the presence of the infection in some cases, greater than normal but in different degrees in others. Consequently, if these anomalies of the spleen are put in relationship with the individual morphological conditions, one will see that even these have their special share in the morbid process.

These considerations have a certain importance, because they render the physician more cautious when he is about to form his judgment on the state of the spleen. If much—perhaps too much—has been written about the mode of defining the limits of this organ, the same cannot be said concerning its physiological constitutional expression according to whether it presents in conditions of health its maximum or minimum development.

I myself, therefore, before making the diagnosis, take into consideration the individual morphological combination, and when I meet with an abnormally large belly, especially if the xipho-umbilical line is disproportionately long, I try to establish whether the slight increase of the spleen can be referred or not to primitive constitutional causes.

In fact, one sometimes observes that the size of the spleen is not modified after the disease has been completely cured. How can one in these cases reconcile the volume of the spleen with the diagnosis, even admitted that it exceeds somewhat the normal average—that average which is not always a sure guide ? And, on the other hand, are there not cases in which the spleen does not apparently become swollen, though one deals with an infective disease ? And are there not cases in which the spleen is smaller than the average, and which, increasing owing to the infective malady, one does not recognize that it is enlarged, because it does not exceed the limits of the normal average ? I maintain that if one gives too much importance to slight enlargements of the spleen, one will run the risk of wrongly interpreting the pathological fact relative to the splenic volume, and consequently it may happen that one will attribute the splenic enlargement to the state of infection, while the reason of its enlargement is very different. I believe that in both cases the exact estimation of the morphological combination contributes to the difficult task which also, in the presence of this particular, the clinician has to perform.

Morbidity of the Third Combination considered in its Relations with the Preceding Combinations.

The pathology of the liver is among the others illustrated by the morphological criteria obtained from this Combination, and by reason of this it is necessary that we begin with the pathology of childhood. And to define clearly the dominion of my researches, I shall speak, according to my experience, of that alteration of the liver which is called cirrhosis of infancy or of childhood.

This is an argument which has not been fully treated by the pathologists ; even the books of pediatrics, if we exclude the more recent, do not display special interest in this disease which I am about to describe in order to show that the morbidity of the liver is connected with the morphological conditions in question. I refer those who desire to know the questions concerning the study of the patients, and especially the etiology of the disease, to the second volume of my *Clinical Commentaries*. Here I confine myself to stating that what has been asserted as to the causes of this disorder will not bear criticism, and is obviously insufficient to produce the morbid effects attributed to it, because the special individual predisposition is the principal cause.

In fact, when one considers that, according to my own observations on patients and those described by others, this disease is met with only in the individuals who exhibit the morphological characters of the Third Combination; that, even before the characteristic manifestations of the malady, the individuals have a more or less voluminous liver, but always larger than pertains to the age and stature; that these individuals present traces of scrofulosis; that, finally, some of them have shown at the autopsy tubercular manifestations, one obtains a complex of facts which clearly demonstrates the necessity of admitting in the organisms a special morbid disposition without which the causes indicated would not have produced the hepatic disease. This is also confirmed by the fact that these organisms, if, as we have already said, they are distinguished by exceptional development of the belly, may more strictly reproduce morphological characters of the First or of the Second Combination, with their relative morbidities. The morphological anomalies of the Third Combination are associated with those of the First for the most part in infancy or in childhood. This is the reason through which the organisms in question, together with the liver abnormally developed or with the liver become swollen, presenting the symptoms of the first stage of interstitial hepatitis, may present scrofulous manifestations, and at the same time, or later on, those of tuberculosis; or, when tuberculosis exists, there may be a complex of complicative hepatic phenomena and also hepatic cirrhosis independently from the other causes to which they are said to be attributed.

From all this, therefore, one is induced to think that these individuals have *a congenital enlargement of the liver which has through this a definite morbidity*; that this *morbidity is specialized in the individual constitution*; that everything makes one believe *that it is the first manifestations of the liver and the others possible in the patient, all congenerous, all manifestations of the predominance of the lymphatic elements in the organization of the tissues, which become the seat of morbid foci.*

The facts and considerations which I have exposed up to now supply us with the anatomical, physiological, and pathological criteria for the criticism which is applicable to that nosographical picture which passes under the name of *Banti's disease*, besides that other which is called *idiopathic ascites*. *Mutatis mutandis*, in both, proceeding to analyze the morbid facts in proportion to the morphological facts, according to which one understands the type of the individual organization and the kind of relative morbidity, we see neither more nor less than the forms of visceral lymphatism. And these forms, as the clinical cases which have been described clearly demonstrate, vary according to the variation of the special individual morphological combinations.

Clinical and anatomical observations have equally convinced me of this. There are cases in which, after having seen the liver, already hypermegalic, become swollen, and then the belly becoming enlarged and ascitic, and the bowels loose and even piles appearing—as I myself have seen in a boy of nine years—and the diurnal fever, one remains uncertain as to the diagnosis according to whether the phenomena of the intestine or those of the liver are more marked. The latter may become prominent, and then, owing to the appropriate treatment, one observes an unexpected improvement and the gradual disappearance of all the phenomena. Perhaps the patient will subsequently die from tuberculosis, as Enoch, among others, has mentioned, and as I myself have seen. At the necroscopy, whether signs of tuberculosis exist or not, under the ordinary appearance of cirrhosis, one observes facts which prove the existence of a process distinctly lymphatic. The size of the liver depends upon the stage which the disease has reached, *but the final alterations of the organ consist in an enormous lymphatic production, which has its origin from the elements of Glisson's capsule and its branches in the liver.* These elements insinuate themselves between the cells of the hepatic lobule, which break down and atrophy. Connective-tissue productions are also met with, and besides the important morphological conditions which are the basis of the individual constitution, one observes aplasia of the aorta ; disproportion between this and the pulmonary artery, with notable prevalence of the latter ; the heart, like the aorta, aplastic or asymmetrical, as it may present a left ventricle, apparently small, but slightly hypertrophic ; the right ventricle may be of normal size or slightly dilated as a whole, or especially at the conus arteriosus ; the veins of the body may be in general very developed, a condition which may be noted also during life.

We shall now return to the facts exposed, and consider them in their first appearance—that is to say, when phenomena begin to manifest themselves which make our diagnosis uncertain, because neither the intestinal nor the hepatic symptoms are so evident, so expressed, as to conform themselves to the picture which is ordinarily called abdominal scrofulosis, or hepatic cirrhosis of childhood.

It is evident that while all is still indistinct, a fundamental note dominates—namely, that which declares the general lymphatic condition of the organism.

If at this early stage of the morbid process we have to diagnose the case and provide, we shall certainly not forget the signification of the morphological attributes of the patient, nor the signs of previous or actual scrofulosis, and to the indistinct morbid picture we will apply the term which suits it better than any other—namely, that of *abdominal lymphatism.*

We shall at present refrain from criticizing the term, and shall occupy ourselves with the thing. This absolutely in its complex could not be otherwise called, as on several occasions experience has taught me.

Sometimes, as I have mentioned, the gastro-enteric symptoms precede or prevail; but this does not entitle us to make the diagnosis of gastro-enteric catarrh, because it is a diagnosis of pure form, because it does not render evident the morphological environment, because the condition of the spleen and liver or that of the one or the other is consequently not the same as that observed in ordinary intestinal catarrh. And if we wished to cede totally to the form, which in similar cases it usually presents, it would be necessary to express ourselves in an unscientific way, beside the intestinal catarrh, making mention of the liver, spleen, perhaps of traces of ascites. This, however, is not a diagnosis, but a simple enumeration of morbid incidents. It is more in harmony with the science, and more useful from the practical side, to unite all these incidents into a generic name, somewhat vague, it is true, but suitable, for it is derived from the knowledge of the intimate structure of the morbid parts and from the estimation of all the factors which give rise to and even complicate the individual morbid cases. The difference is too great which obtains between a catarrh of the digestive tract casually produced—for example, *ab ingestis*—and that which instead is connected with reasons of original and individual morbidity existing in the belly.

Otherwise proceeding, it happens that, after having declared that it treats of ordinary gastric catarrh (because, whatever be the course which the morbid process will take afterwards, the intestinal symptoms will always be present), it will be necessary to recognize either the appearance of the symptoms of scrofulosis of the abdominal lymphatic glands, or those of scrofulous peritonitis, or those, more rare, of hepatic cirrhosis. This means dragging the diagnosis along for a long time before concreting it, leaving the organism for a long time deprived of the most efficacious treatment, not interpreting physiological facts as well as pathological and therapeutic indications, when instead, to correspond duly to the aspirations of preventive medicine, it was necessary to have recognized from their first appearance the nature of the sufferings, the reason why they are nearly always habitual, and their ready complication.

If in the presence of the above-mentioned physio-pathological conditions we make the diagnosis of *abdominal lymphatism*, we will show that we have a definite, though perhaps vague, conception of the symptomatic manifestations. If to the general term of abdominal lymphatism we add other particulars, according as the cases offer us either phenomena of the intestine, or of the spleen, or of the liver, or of the kidneys, there will be no change in the diagnosis, but the progressive confirmation of it, following the evolution of the morbid process. Whatsoever be the condition of the little patient or of the adult patient, we will interpret its most important therapeutic indications. If it has not exceeded the limits of a curable affection, it will be judged in such a way that, consigning to its history the special and scientific name of the previous morbid condition, it will in the future be succoured by the most suitable hygiene. And the anamnesis, always necessary for the diagnosis of future infirmities, will give us valuable information, because it is referable more to the nature of the past sufferings than to the form and vague appearance.

In fact, these individuals present, as a rule, during youth, adult age, and virility their morphological type, and consequently their special morbidity.

I have said that I intend specially to occupy myself here with the pathology of the liver ; therefore, returning to this, I wish to state that those who from infancy have the morphological characters which form the constitutional basis of abdominal lymphatism, with marked prevalence of the hepatic phenomena, carry in them the special morbidity of the liver. In the special morphological condition resides the reason of the predisposition to hepatic lesions which lead to cirrhosis, and the more frequent and manifest during infancy and childhood the hepatic phenomena are in the individuals who have an abnormally large belly, even without reaching the exceptional size special to the Third Morphological Combination, the more the hepatic tissue is to be considered inclined to lymphatic irritation even in the other periods of life.

This, according to my experience, is the organic reason of the susceptibility of some to the causes to which the appearance of hepatic cirrhosis is usually attributed—causes which, truly speaking, act so frequently that there ought to be a number of cases of hepatic cirrhosis much greater than that verified by experience ; causes which do not succeed in producing cirrhosis even when they act for a long time and intensely in some individuals, while in others they give rise to it acting with less intensity and duration.

This special predisposition of the hepatic tissue in certain individuals explains why some patients suffering from tuberculosis or from heart disease present in the liver marked alterations which lead to the form of cirrhosis noted in these cases, and which are absent in other patients affected with these diseases. And the same can be said of the hepatic cirrhosis that is met with following chronic tuberculous peritonitis. When it exists, it always expresses the special morbidity of the organ according to the degree and extent of its alteration.

Even admitting that the Morphological Combination of infancy can be modified, as really occurs in some cases, nevertheless, the morbidity of the liver more or less marked remains, almost as if to signify the primary constitutional condition. When this exists, and according to its degree, it will influence the other causes on which the interstitial hepatitis depends.

He who has followed attentively the arguments of the foregoing pages will be in the position to understand why I am about to apply them to the interpretation of the interesting picture of *obesity* or *polysarcia.*

One can frankly assert for polysarcia what we have seen happen for cirrhosis ; for polysarcia, also, several causes have been indicated ; but these would not act if they had not been preceded by a particular disposition in the individuals.

A predisposition has been admitted by all the ancient and modern writers, but this predisposition is made to consist vaguely in *heredity*, the *phlegmatic temperament*, or the *lymphatic constitution.*

Are not the maladies numerous whose pathogenesis is assigned to the lymphatic constitution, the phlegmatic temperament, and torpor of innervation ? It is almost astonishing that clinical observation has not discovered certain somatic relations which present themselves in the obese, and which differ considerably from those observed in individuals of lymphatic constitution and which we know already.

I have had occasion elsewhere to refer to the obesity which manifests itself, as a rule, in individuals pertaining to the First and Second Morphological Combinations with attributes of the Third in the proportions of the abdominal cavity. I showed that it is due to the changed morphological conditions, through which the individual, having survived in the early years the lymphatic and scrofulous manifestations, reached a new phase of development in his thoracic organs, the primitive exceptional development of the abdominal cavity remaining constant ; and I also showed that individuals of the Second Morphological Combination after a certain age inclined to obesity more or less according to the excessive development of the belly and to the coexistence of venous plethora.

These two facts, if I am not mistaken, are very important, because they suggest a distinction that must be made of the cases of polysarcia which are especially met with in persons belonging to the Third Morphological Combination. The fundamental character of this Combination consists in, as we have mentioned, the exceptional development of the belly, it being able, besides, to reproduce the signs of the First or of the Second Combination. This means precisely that *obesity may manifest itself in him who has, above all, the lymphatico-scrofulous constitution, or principally the plethorico-venous constitution.*

This is derived from clinical experience. We have only to consult Bouchard's[1] work to see that polysarcia may be preceded and even accompanied by morbid manifestations which pertain to one or other of the two First Morphological Combinations. Further, reading what has been written in the treatises of special medical pathology from ancient times to our days, one will find a large number of facts and ideas which confirm fully my general pathological conception regarding obesity, while they also justify the distinction that I have proposed.

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[1] Bouchard, *Maladies par ralentissement de la nutrition.* Paris, 1882.

Polysarcia is hereditary, may be associated with gout, diabetes mellitus, hepatic or renal calculus, and may in the succeeding generations alternate its heredity with that of the other diseases just mentioned and with tuberculosis.

It may have relations with special manifestations of the nervous system, and above all with hysteria. It may be connected with the habit of overeating, a sedentary life, and the sexual function.

To be exact, it would be necessary to distinguish as many varieties of obesity as there are clinical forms, and to fix to each variety its morphological character; but up to now we do not possess a sufficient number of investigations directed to this scope.

Meanwhile, the division which I propose, and which can be the point of departure for other observations, is as follows:

(1) Plethorico-venous, (2) lymphatic, (3) scrofulous polysarcia.

How can the increased capillary circulation in the tissues of those who have become plethoric be explained?

I believe that these individuals are endowed with an excessive assimilation through which they gradually become plethoric, and have in consequence in the peripheral capillary system the production of vessels, owing to mechanical reasons (excess of intravascular pressure) and to biological reasons (irritability of the vascular protoplasm).

When dealing with the comparative physiology of the digestive process, I mentioned the relations which obtain between obesity, gout, and diabetes. On the same occasion we saw that the previsions conceived from organic chemistry corresponded to the morphological characters anatomically verifiable in the individuals affected with these diseases.

Now we have only to clench this conception with clinical observation. We can maintain that the same corporeal proportions which give rise to polysarcia may be met with in the gouty and the diabetic.

Notwithstanding this, there are cases which rigorous clinical observation can present to us in confutation of our assertion, because not all the gouty nor all the diabetic patients present an obese appearance. It is well known that there are diabetic and gouty individuals who have never been fat. The distinction is very notable which can usually be made between thin diabetics and fat diabetics, as well as the disposition of the former to tuberculosis. I cannot understand why a similar distinction has not been made of the gouty into fat and thin, nor why the rare but very important cases of gout which become tuberculous are almost forgotten.

What I have said of polysarcia, distinguishing it from the cases of obesity which are met with, as a rule, with advance in years in those who primarily presented the morphological signs and the corresponding symptoms of chronic affection of the chest, but who gradually became transformed, I can equally say of gout and diabetes.

But inasmuch as it is not my object to deal systematically with the pathogenesis of these diseases, but only to show the relations which they have with different individual morphological conditions, in order that these can be put in greater evidence, associating them in such a way as to constitute a definite morphological combination, it will be useful to pass in review the morbidity inherent in the Third Morphological Combination and its varieties.

For greater clearness we must distinguish two categories of individuals :

1. Those who have characters resembling the individuals of the First Combination, and—

2. Those who have characters resembling the individuals of the Second Combination.

We see that the resemblance refers to the development of the thorax and of the heart.

1. When there is a *relative* deficiency of the thorax from infancy to adolescence, we frequently meet with epistaxis, though the appearance of the patient is reassuring and the general nutrition can sometimes be said to be more than satisfying. The fat is sufficiently abundant. Occasionally, feminine outlines are exhibited in the male, and in the female also the fatty tissues render the hips and bust more prominent than normal. Besides

these phenomena, during childhood and towards puberty one also sees some indications of lymphatism either in the neck, or fauces, or the skin. Some individuals are susceptible to every seasonal influence, are almost persecuted by every epidemic prevailing, and all this contrasts with the continuously increasing appearance of floridness.

As a rule, when one recounts the history of these individuals, and begins to describe their healthy growth in childhood, one makes mention of the maladies of infancy which they readily got over as a proof of their sound constitution. Well, all this includes an error. Instead of knowing that these individuals have readily recovered from the diseases of childhood, it would have been more useful to know that these diseases had been avoided, or at least that they had presented themselves in their mildest form, because the best constitution declares itself in this absolute or relative immunity, while the greater morbidity is associated with the greater propensity shown to contract infective diseases during childhood. I am convinced by the clinical histories before me that the more the children of florid appearance are susceptible to infective diseases, the more they show the signs of lymphatism, especially if they follow a dietetic system not strict, though it is commonly said to be regular and necessary. It is not necessary, because it is very frequently excessive ; it is not regular, because it is varied in quantity and quality according to the caprices of the children, and to the unreasonable compliance of the mothers. In fact, if we study carefully the physiological history of these individuals, we will succeed in recognizing functional anomalies of the intestine almost constant, though mild, or they manifest themselves from time to time with characteristic phenomena.

As these individuals approach puberty, attacks of hemicrania are scarcely ever wanting, and although this may be considered a disease of the family, inherited, one observes that it is very frequently determined or favoured by excesses of the table or by abuse of nervous function. By reason of this, one must always distinguish the erethistic character from the others, as that which helps to exaggerate the constitutional manifestations, and which —as the evolution of the organism gradually proceeds—accompanies their final morbid expressions.

In these individuals from adolescence one sees with some frequency the proclivity to articular rheumatic manifestations, and generally with a chronic course. The small joints of the hands and some of the large joints, not excluding those of the vertebral column (though these are more rarely affected), become painful and swollen, and when they exist for some time two conditions are met with—tension of the soft articular parts produced by effusion, and enlargement of the articular ends. These articular alterations last for years. They are called rheumatic, and up to a certain point this name may pass, if we take into consideration the great facility with which these patients feel the changes of weather ; but in reality they are connected with the particular susceptibility of the tissues, with the special nature of the local nutrition, which in all resembles the lymphatic productions. The course, complications, and treatment all correspond to this conception, and I call these arthrites more lymphatic than rheumatic. They associate themselves with nervous erethism or nervous torpor, and thus these cases, for the most part rebellious to every kind of treatment, take different forms.

And their general aspect is satisfactory, and, as I have said, sometimes even excellent apparently. On the other hand, if the blood be carefully examined—an examination which must not stop at the rosy colour of the cheeks and the vivid colour of the mucosæ, because here the richness of the capillaries may mislead us—one observes that the red corpuscles are not well coloured, or are relatively scarce, or that there is a considerable amount of leucocytosis, in spite of the iron treatment even when protracted. Nor does the reconstituent treatment, or the air of the mountains, or that of the sea, or gymnastics, change radically these conditions of the blood, though they may improve them. This is proved by the fact that these patients find it necessary to make repeatedly the same medicinal and climatic treatments.

Disturbances of the mucosa of the digestive or of the respiratory tracts are not infrequent.

Between adolescence and mature age the morbidity may become modified. One not rarely sees these individuals promising, cheerful, healthy of aspect, fall a prey to the disease least suspected, especially by the laity—pulmonary phthisis. The mere mention of this fact will recall to the reader's mind the history of similar cases which have been the means of giving rise to unfavourable opinions about our science, because *no one*, it is usually said, could have foreseen the sad event ; and then they mention the names of the medical attendants and consultants, and end by assigning the disease to the most innocent causes, unless, owing to the height of ignorance, they accuse the treatment itself advised by the doctors.

This mode of judging things ought to cease even for the decorum of the science. Observations are not wanting in this connection which have led able physicians to be mindful of the seductions of the apparent floridness of the individuals in question, and to transmit by tradition that a certain exuberance in the development of the body must not leave us tranquil, because it may be the indication of a nutrition which participates in the characters of those lymphatic constitutions in whom the production of panniculus adiposus is, as a rule, abundant.

When dealing with the First Morphological Combination, we stated that the precocious growth in the skeletal height was not accompanied by corresponding development of the heart, arteries, and thorax as a whole. Well, in these individuals of the Third Combination, though they are rich in fatty tissues, which helps to give them the undeniable appearance of health that we described ; though the development of the capillary system of the skin, and especially of the capillaries of certain parts—the face, for example—also misleads us as regards the condition of the blood, owing to the relative defect of the chest and the nonconformable development of the left ventricle and of the arterial tree, circulatory relations are established similar to those which we saw in the First Combination. These determine a new morbidity in the circulatory centre. In these individuals of the Third Combination the skin, panniculus adiposus, and the fatty connective tissue in general, are more richly provided with bloodvessels, especially veins, than in those of the First Combination. The fatty tissues therefore develop by preference, together with the lymphatic elements, which in the same manner profit by the above-mentioned hydraulic disposition.

These facts do not always present themselves in equal degree ; hence arises the great variety of the morbid conditions which depend upon them.

If the evolution of the organism proceeds in this way regularly to adolescence, we have the continuation of the conditions noted during childhood, which even accentuate themselves and become complicated with those of the special combination to which they more strictly appertain, as we shall see, also according to the efficiency of age.

The tendency to obesity becomes gradually more marked; catarrhs of the mucosæ in general intervene and alternate with rheumatic or rheumatoid manifestations. If, however, the hygiene, owing to its having been better directed, or some disturbance in the abdominal functions, check the tendency to the accumulation of fat, or if the previous morbid conditions of the respiratory tract in the cases of defective development of the thorax have assisted in modifying the course of the general nutrition, it may happen that the individual will not again present his former appearance, and will have lost the tendency to the accumulation of fat or much fat. And this is a mode in which the Third Morphological Combination can be transformed.

There are two different but equally important cases which can be compared from the morphological point of view as follows: the one even in adult age conserves its proportions almost unchanged, the other has the belly less developed.

And here it is opportune to refer to another element—namely, the abdominal circumference, which in the former case is more or less enlarged. It may also be enlarged enormously, and, what is important, enlarged corresponding to the hypochondriac regions.

Examining the things more minutely, we find other very interesting facts. In the individual whom for the sake of brevity we shall call *fat*, one observes a true and abundant development of the network of small and very small peripheral veins; in the other, whom we shall call *thin*, the large veins only may be visible; some in the legs also appear varicose, but this is not the rule. The former has all the characters of venous plethora, the latter has at most a very slight and partial indication of them.

From this time onwards the conditions of the individuals gradually differentiate themselves with increasing years. Other morbid facts may also intervene, which we shall describe further on when we have accompanied to the same epoch of evolution the individuals who, instead of participating in the First Morphological Combination, participate in the Second.

2. This category of individuals as children and even youths are types of robustness. The early tendency to excesses of the table is justified by the continuous activity of the body. These

little gourmands are the marvel and the delight of their parents, though the abdominal disturbances—whose cause they usually wish to see either in external influences or in that which is regarded as an error of diet, which in this case must be considered an excess of the error—indicate the special condition inherent to the Third Morphological Combination.

But the resistance of the individual—who from the unexpected disorder of health resumes his habitual bodily exercises—and his tendency to find in these the best method for satisfying his juvenile instincts—that is, the instinct of motility—remove all doubt regarding the health and morbidity of the organism, which presents itself as an example of robustness and strength.

Nevertheless, in some individuals before, in others after, puberty indications of piles and of neuralgia present themselves, which later on become more intense, more habitual, and acquire their characteristic clinical appearances.

So long as the individual, by means of gymnastic exercises, can accelerate the metabolism, the morbidities, which at least one dreads, owing to the criterion of heredity, remain latent, if the symptoms of the hereditary disease do not quickly manifest themselves—that is to say, obesity, diabetes, or gout, and all the other phenomena which are attributed, as a rule, with expressions almost repudiated nowadays, to the arthritic and herpetic diatheses, and are : flatulence, acidity, weight at the epigastrium, cramps, gastralgia, slowness of digestion, eczematous eruptions, urine frequently sedimentous with excess of urates.

The distinction which we have made, in homage, so to speak, to the nature of the facts, of the individuals appertaining to the Third Combination having certain characters of the First into the *fat* and the *thin* is useful also in the analysis which we are making of those who have instead characters pertaining to the Second Combination. In reality, here the *fat* individuals are those who early denote a marked tendency to obesity ; the others, though they show a certain tendency to obesity, cannot be called polysarcic. Both have in common the phenomena exposed above, and these, consequently, are differentiated according to whether they be found in the *thin*—that is to say, relatively thin—or in the *fat* (decidedly polysarcic).

The former grow fat later than the latter. Earlier than the latter they may offer hepatic disturbances, nephritic pains, and with or without these denote a distinctly nervous character; consequently they suffer from headaches, vertigo, visceral neuroses, rheumatic attacks, or distinctly gouty attacks, neuralgia in the limbs, and so forth.

I have said that the symptoms of hereditary diseases, which in this case would be obesity, gout, diabetes, sometimes manifest themselves very early. The examples of this fact are rare, it is true, but, considered from the point of view of their early appearance, they acquire no slight theoretical importance.

If we observe these individuals, still young in years, and sometimes very young, rendered powerless by disease, we shall have an impression very different from that which we receive, for example, from those who in youth appear to be threatened with chronic disease of the lungs. The latter, even when very seriously ill, retain their young character and habits; the former, on the contrary, may be called undoubtedly old or aged before their time, whether we consider them in their corporeal forms, or in their habits, movements, the process of nutrition of all the tissues in general. It is not necessary for me to say that the fat is a product of decadence of the organic activities, nor is it necessary for me to modify these lines and the biological conceptions inherent to them if, instead of a polysarcic in youth, one consider a young gouty person, because one can say that he will be inclined to obesity, or, being abnormally fat, a polysarcic with gout, not a simple gouty person.

It appears that these organisms have passed through a process of evolution in a shorter time and in an anomalous mode, especially if we consider the facts inherent to the circulatory system, in which the indications of decadence quickly manifest themselves by reason of the alterations, which in this system are, I would almost say, characteristic of senility. But the things are not in reality always what they seem, as we shall see in its place, studying the possible changes of the Third Morphological Combination.

Before proceeding further, I must deal with the condition of the circulatory apparatus in the individuals whose physio-pathological history has been sketched in categories (1) and (2), because it is important.

I have said that the development of the thorax in the individuals belonging to category (1) resembles that of the First Combination—that is to say, the thorax is relatively less developed than the belly.

The defect of development of the thorax is associated with not only a relative defect of the respiratory organ, but also a relative want of harmony in the development of the heart.

We have seen that when the individuals of this category reach a certain period of life, they become disunited and separate into two series—the *fat* and the *thin*. Well, the development of the central circulatory system is different in the two series.

This has already been hinted at when speaking of the different manner of development of the peripheral venous circulation, and showing that in the *fat* the manifestations of a certain degree of venous plethora prevail, and that in the *thin* this is much less or very slightly evident.

Experience has taught me that all these facts are in relationship with different development of the heart. It is also necessary to note that what we shall reveal in the individuals pertaining to this category agrees with analogous relations registered by comparative anatomy in the lower animals. The difference which we shall find in the heart of the *thin*, as compared with that of the *fat*, is also observed between, for example, the heart of the hog and that of the dog.

In the *fat*, though the heart may show dimensions proportionate to the stature, the development of the right heart prevails ; in the *thin*, on the contrary, that of the left heart.

If from the knowledge of the proportion which obtains between the development of the abdomen—which is excessive—and the development of the thorax—which is rather defective—we pass to that of the different proportions of the heart, we shall comprehend more readily the different modes of behaviour of these organisms, though they may up to a certain time appear equal as a whole. This is demonstrated sufficiently by what we have already said. However, one will understand it equally, because these individuals, when attacked by an intercurrent acute disease, offer also in respect to this a particular expression of the phenomena inherent to the heart. Here also experience teaches us how much the greater resistance favours the course of the disease in the cases called *thin*, as compared with the less resistance which contributes, on the contrary, to aggravating the disease in the *fat*.

If, then, having studied the general morbidity, we search for the reason of the appearance of the cardiac phenomena in the *fat*, and of the other cardiac phenomena in the *thin*, we shall certainly have to consider the different mode of functioning of the heart, the different degree of activity which is displayed by the ventricles, the special physiological changes which the law of functional action has to undergo through the different ages, and by reason of different hygienic influences.

This effort is different from that which we have studied in the individuals appertaining to the First Morphological Combination; it is that which arises owing to excess of the digestive capacity, and which, *mutatis mutandis*, is subsequently used up by circulatory difficulties of the same kind and in a different way, according to whether the left ventricle or the right ventricle prevails.

The excess of digestive function carries into the circulatory torrent an amount of material which will increase the resistance in the arterial tree or in the venous tree according to whether the former or the latter, by virtue of its special morphology, predominate. But the former predominates in all the cases, so that it is a question of degree only, as we see. Hence it is that in these individuals we see the right heart especially prevail with all the symptoms of venous plethora already indicated, or in a minor or a minimum degree; while when the symptoms of venous plethora present themselves in a diminishing degree, one observes a proportionately greater capacity of the left ventricle.

Clinical observation shows us that in reality the cardiac sufferings which are met with in the individuals in question are such as correspond to the preceding. In the *fat*, we see more frequently and chiefly the phenomena of dilatation of the heart; in the *thin*, the contrary. These two terms represent the extremes of the series in which are contained examples of every kind, and which occupy a post from which the more they are removed from the extreme of the *fat*, the more they approached to that of the *thin*. And what I have said regarding the anatomical condition of the heart naturally extends to all that which is connected with the heart, and which regards the general circulation, whose mode of behaviour we have seen in the two extremes; and in this way occur the morphological factors inherent to the circulatory system, that contribute to the special morbidity of the individual.

To these are due the phenomena of general and partial venous plethora; those of the mode of mechanical function of the heart; those of the lungs, liver, kidneys, and the very numerous clinical and anatomical variations depending on the participation of these organs in the disease—a participation which, being the expression of the morphological variation, is also the expression of the conditions preceding the disease determined by the same morphological variations, for the reasons elsewhere adduced.

Just as, when speaking of the First Morphological Combination, we saw the factors which may sooner or later lead to nutritive alterations in the arterial system, independently from external causes, and in individuals destined more or less to be victims of chronic pulmonary diseases, so in these we see the functional conditions of the circulation constitute themselves, though in a different way, which, in the series we are considering, can, in a variable degree, give rise to the same alterations. And when one reflects on those cases in which, owing to the special morphological circumstances, the development of the right heart becomes prevalent, and an increased degree of pressure in the pulmonary artery with symptoms of venous plethora becomes constant, we shall comprehend the physiological basis of the special morbidity which manifests itself also in the dominion of the pulmonary artery.

If to all these facts and considerations we add those noted when speaking of the morbidity of the liver, the interpretation of many complex clinical facts will become clear, which are, as a rule, attributed to external causes, hypothetical causes, or even to true causes, without ever taking into consideration the internal, morphological, predisposing causes, which slowly prepare the suitable inclination in the organs and tissues to feel those others, which otherwise would have no effect, or would act differently, or would be capable of altering the organic functions in very different measure.

Passing now to the individuals appertaining to category (2)—that is to say, those who, in the proportions of the thorax and of the organs contained in it, repeat the morphological conditions of the Second Combination, which, besides the exceptional development of the abdomen, may have more or less excessive proportions of the chest—we find ourselves confronted by another order of important facts.

Here, also, in order to simplify the description, the individuals are roughly divided into the *fat* and the *thin*—the polysarcic proper, and those who do not reach the degree of true obesity, but are more or less well provided with fat. Well, I would mention that these likewise represent the extremes of a series, and that consequently we must again conceive the possibility of all the morphological variants which form the basis of the different morbidity, the fundamental characters of the Third Combination, however, remaining fixed.

Even with equal proportions of the thorax in these individuals, one meets with unequal developments of the heart and of the entire circulatory system. Here, also, observation induces us to distinguish two extremes : on the one hand, we see prevail the right ventricle and the venous tree in general, with some variations in definite regions of the body ; and, on the other, the left ventricle and the arterial tree. We have, therefore, the two forms of plethora—venous and arterial.

Nevertheless, the arterial plethora of this series of organisms does not reach that high and classic degree of development and of manifestation which are observed in the individuals of the Second Morphological Combination, just as the morbidity of the respiratory apparatus studied in category (1) never reaches that exquisite, and, I would say, almost fatal manifestation of the organisms belonging to the First Combination.

When by virtue of these comparisons made on the basis of the morphology of the organisms, truly naturalistic conceptions are rooted in the mind of physicians, they will change, I have no doubt, their judgments and previsions, and the work of preventive medicine will much more easily intervene. Every time that I have to examine a patient presented to me for the relief of the symptoms and the morbid form, I address myself to the applications of the morphological observation to the treatment and the prognosis, and here I not infrequently meet with observations on the part of my colleagues accustomed to read in the patient nothing beyond the symptoms which respond to a given nosographical picture, forgetting that the organism, such as it is, expresses what it was and what it will be in its morphological conditions—the necessary basis of the preceding, actual, and future morbidities. I intend to deal with this question in another work, where I shall have a larger field for developing these conceptions, and showing that very frequently the theories which are not founded upon the natural history of the organisms, however seducing and brilliant they may be, end by limiting the field of observation, and, in consequence, paralyzing the more logical expansions of the mind of the clinician every time that he gives exaggerated importance to the dominating theory, as is generally done both in conceiving the pathogenesis and diagnosis, as well as in thinking out the therapeutic programme for the concrete case. I shall now return to the argument.

Here, also, to the above-mentioned conditions inherent in the circulatory system is added the part which appertains to the special morbidity of the abdominal organs, and in this way we compare the general picture of the morbidity proper to this group of organisms, which, as I have said, represents a series with its two characteristic extremes and the relative intermediate variants.

Every physician who has followed me in this exposition, and has already acquired extensive clinical knowledge, at this point will have seen arrayed before him a multitude of patients whom he has treated, and in whom he has noted differences—in spite of the uniformity of the clinical name by which they are usually indicated—which not rarely are brought forward as an argument for excogitating theories, or for undertaking new observations, or for registering some discrepancy between the doctrine and the facts observed.

Here in reality we have organisms which acquire either vigour or the character of special weakness. If the aspect of the body and the general nutrition accord with the former, with the latter, on the contrary, these are in open contrast : the vigour is greater in those in whom the note of arterial plethora is greater, less in those in whom the note of venous plethora predominates. In the former the musculature is firm, in the latter the size of the body is due to the greater accumulation of fatty tissues. With these are disclosed phenomena belonging to the lymphatic nature of some parts especially—for instance, the belly at first, later the skin, mucosæ; and this is always less feasible in proportion to the prevalence of the characters of arterial plethora. In both there are hæmorrhoidal manifestations ; but these reach a different intensity and degree according as the general symptomatology of venous plethora is associated with phenomena of the special morbidity of the abdomen, because precisely two different contingencies present themselves—namely, in the dimensions of the abdominal cavity, exceptionally developed in all, those prevail which are derived either from the greater development of the organs whose venous system discharges into the inferior vena cava directly, or from the greater development of the others which pour their venous blood into the vena portæ. The more marked the clinical manifestation of the arterial plethora is, the less easily, either as a primary disease or as a complication of any other whatever, will the endarteritis appear, according to the cases favoured or not by the kind of hygiene, and to the morphological variations in respect to the different parts of the organism ; for it is known that, *cæteris paribus,* in some parts of the organism the arterial circulation may present exceptional anatomical modifications not only in respect to what the anatomists call arterial anomalies, but also in respect to the size of the artery, and in consequence to the blood-mass which normally traverses that arterial province. In this connection I may mention what is observed in the cerebral circulation, hepatic circulation, and so on.

If to all this we add the differences which may obtain concerning the development and function of the nervous system in general and in its parts, I can undoubtedly assert that we shall have gathered together the chief elements which constitute that series of organisms which we are studying, and which attest that the one-sided conceptions followed up to now in pathological investions must be abandoned.

Thus one has arrived at comprehending the different manner of expression of many facts which are intimately connected with pathology—for instance, the cutaneous, urinary, and hepatic secretions. When I think of the calculations ingenuously founded on the averages presented by the physiologists for discussing the pathogenesis of infirmities which have, superficially considered, equal appearances in individuals who differ from one another in many morphological conditions, I feel vividly and earnestly the necessity of many other researches which have not been instituted or even thought of. This refers not only to the group of organisms which we are examining, but also to all in general.

Having described the variations in the fundamental morphological picture of the individuals pertaining to the Third Combination, we can now take up the thread of the physio-pathological history which we have followed up to mature age.

Some readers may think that *mature age* is a very vague term.

It seems so, but it is not, if we consider that, especially in the individuals we are examining, the limit which indicates physiologically one or another period of life is very variable ; therefore, if I am not mistaken, this expression is required by the condition of things.

We must still keep to the distinction that we have made of the organisms of this Third Combination into the *fat* and the *thin*, both for those which, under category (1), we studied in the characters that were similar to some of those special to the First Combination, and for those which, under category (2), we said had characters special to the Second Combination.

All these organisms have, therefore, a common endowment—namely, that of the exceptional development of the abdominal cavity. When they have reached a definite period of life with the relative morbidities, taken together and examined in the clinical speciality which they present, we find that we must under every point of view divide them according to the maladies which they present as follows :

Diseases of the vascular apparatus.
Diseases of the locomotor apparatus.
Diseases of the abdomen.
Diseases due to anomalies of metabolism.

We shall begin with the examination of the first. Here figure those diseases which are, as a rule, said to be due to rheumatic influences, the organisms of the Third Combination having in general a special predisposition to suffer from the influences of this kind of cause. And if we wish to understand the pathogenesis of the heart affection already begun, or, better, to interpret the genesis of the special symptoms which in the different cases will present themselves to us, we must take into consideration the morphological conditions. These, indeed, according to whether the individual appertains to series (1) or to series (2), and according to whether he be *fat* or *thin*, will assume a definite form, and have a corresponding course and complications.

Taking into consideration the heart affection—for example, mitral insufficiency—in the different categories of organisms, we shall find as follows :

In the *thin* of series (1) predominate phenomena of the respiratory apparatus by reason of the ready, extensive, and constant pulmonary circulatory alterations.

In the *fat* of the same series prevail abdominal symptoms, including the hepatic; according to the other possible varieties, also the renal, and so on.

In the *thin* of series (2) predominate symptoms of cardiac hypertrophy, of tumultuous arterial circulation with phenomena relative to the cerebral and pulmonary functions.

In the *fat* of the same series prevail symptoms of weakness of the heart with strong development of the right heart, hepatic enlargement, and hepatic and renal complications.

In the *thin* of series (1) and of series (2) chronic joint affections may present themselves; but more frequently in the former than in the latter, which record more the joint affection suffered: the chronicity of this in the former reveals the morphological relations with the First Combination; the more important cardiac form in the latter recalls the morphological relations with the Second Combination.

The treatment in every case must be adapted not only to the symptomatic requirements of the heart affection, but also to the individual morphological requirements; in those in whom the plethoric condition, either general or local, predominates, the following indication exists: The more accessible to our means the phenomena which depend on it are, the better the result of the treatment; the better interpreted the requirements of the organism as well as of the cardiac affection, the more efficacious the treatment. The latter must not be systematically directed to the cardiac affections by means of the remedies which act only on the heart, but must also be suitably employed for modifying in the organism the conditions which are opposed to the regular organic function.

Therefore, employing in due measure the direct or indirect abstractive treatment according to the cases, one will see the general functions and those of the heart sufficiently restored.[1]

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[1] If these precepts were followed in advanced cases of heart disease with the idea of obtaining their improvement, this most probably would not be obtained. That which I maintain must be practised early, before the conditions of general nutrition and all the physiological requirements which depend upon it are profoundly perverted. This has been suggested to me by experience. I remember cases in which, having proposed the above precepts, they were not

In the *fat* organisms of series (1) and of series (2) it is necessary to diminish the phenomena of the general venous plethora, and here also the abstractive treatments, when performed in time, will be useful for preventing the visceral stases which oppose themselves to the best course of the phenomena of nutrition. If at the same time we prescribe suitable dietetic rules, we will satisfy the fundamental requirements of the organism—that is to say, to lessen the blood-mass, maintain the organic balance within its strictly normal limits, and contribute to the diminution of the obesity in a convenient measure.

In the *thin* organisms of both series local abstractions at the anus are specially indicated. In all, however, the special condition of the circulatory phenomena represents a symptomatic indication depending on the morphology of the organisms ; therefore, the prescriptions must always be in agreement with the individual requirements.

Among the diseases of the circulatory apparatus we wish to take into consideration that which is commonly known by the name of *atheroma.* If we remember the cadaveric findings considered almost equal by pathological anatomy in individuals who presented different symptomatology, this again shows the great difference which obtains between the observation of the biological fact in action and that of the anatomical particulars supposed ; if we remember all the anatomico-pathological varieties of atheroma, the question spontaneously arises, Why so much difference in the clinical and anatomical facts ?

To respond in an adequate manner to the nature of the facts which we are investigating is extremely difficult, because here are hidden many causes of error, and my observation is not

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applied in time, because my colleagues thought it was the better part to criticize and condemn them. However, other methods of treatment having failed, they then had recourse to my suggestions, but without deriving advantage from them. Naturally, the opinion which was formed of my treatment was unfavourable. But when I have had the fortune to meet with colleagues who, either convinced by my words, or owing to a feeling of duty, carried out the treatment in time, I have noticed that I came by colleagues who before were accustomed to follow a different method of treatment. Besides, I can note here only some therapeutic generalities ; to satisfy a complete method of treatment for heart diseases I would have to add very much more. This I say to those who may think that in the general precepts expounded above I intended to express the whole of the therapeutics of heart diseases. With regard to this, I believe that I have described other important things dealing with heart affections in general, and with certain complex morbid states in particular, in vol. i. of *Clinical Commentaries.*

sufficiently extensive. It would be necessary to know if the cases of atheromasia which we desire to study, and which are not in direct relationship with the special morphology of the individual, are identical with those produced by syphilis, dyscrasial, infective, and other causes. Nevertheless, I believe that I have arrived at some useful results also in this matter.

The organisms of the Third Morphological Combination present, as a rule, the greater disposition to the disease ; but those of series (1) present it in minor degree as compared with those of series (2). The latter, compared with the former, together with the disease of the arteries, suffer from more frequent and more profound alterations of the heart. In this connection I must mention that I have found with the alterations of the atheromasia the endocardium and the heart less altered in the individuals appertaining to the First Combination.

In the *thin* of series (2) one more frequently meets with examples of diffuse atheroma. This must be put in relation with an analogous fact—namely, that of the diffuse atheromasia which is observed in the organisms of the First Combination, and which, having survived the vicissitudes of youth, are transformed, and acquire the morphological attributes that record those of the Third Combination.

In the *thin* of series (1) and (2) atheromasia of the arteries of the head occurs more frequently and earlier. This establishes an important fact, because, if we compare the morbid processes of the nervous system to which the individuals of the Third Combination are subject, we can divide them into two categories : in the *thin* predominate the hæmorrhagic phenomena, which appear suddenly without notable precedents ; and in the *fat* the chronic and diffuse passive congestions, which proceed and slowly accompany the secondary hæmorrhages. Consequently, in the former the hæmorrhage occurs without warning ; in the latter it is prepared, and I would almost say with an invading form. If we consider the morphological conditions of the circulatory system, and the manner in which the vascular function in general, and in its different sections in particular, is performed, one can interpret better these clinical facts than by having recourse to other causes, for the most part hypothetical.

I have collected not a few facts relative to other coincidences of atheromasia in the viscera, and though I cannot now make useful practical applications of them, they have enabled me to perceive other relations between the visceral morphological facts and atheroma of the visceral arteries, so that, persisting in this kind of research, clinical observation will be rendered more acute. I remember facts which seemed contradictory, but which, if studied better in life, would have in reality contributed to this question. In the cadaver of a patient who died from symptoms of general exhaustion attributed to malaria, age, and poverty, I have seen all the principal arteries of the abdomen atheromatous. In another case, with arterial lesions much less intense and extensive, but well determined in the ciliac and hepatic arteries, symptoms of chronic intestinal disease with enterorrhagia were verified. And in thinking over these exceptional cases and others similar, I must confess that in spite of the greatest independence, the greatest initiative in observation, one frequently falls into conventionalism, both in naming the symptom which is observed and in interpreting it. I must also state that atheromasia of the abdominal arteries coexists with anatomical conditions, which indicate an abnormal development of the arteries.

Another disease of the circulatory apparatus is *arterio-fibrosis*. It is necessary to explain myself first of all. I here allude to the clinical fact which manifests itself, as a rule, in a definite way with cardiac, renal, cutaneous, and nervous phenomena, by which is determined a picture of symptoms, at the bottom of which is interstitial nephritis, with an equipment more or less large of symptoms on the part of the heart.

Arterio-fibrosis is met with more frequently in the *thin* of both series, but the contingent of the *thin* of series (1) is greater than that of series (2).

This necessarily induces us to refer to the cases of equal infirmity which may be met with in the individuals of the First Combination when, having transformed themselves, they have reached mature age. For this, also, the explanation is derived from the special morphological conditions of both, which are similar, inasmuch as the *thin* of series (1) of the Third Combination retain during childhood a note which is the morbidity of the lymphoid tissues special to the First Combination; hence these individuals, transforming themselves, can modify their primitive morbidity without losing it completely. Here the morbidity of the lymphatic tissues manifests itself chiefly, but not exclusively, in those which are found surrounding the vessels and diffused in the interstices of the organs, as is demonstrated by microscopic observation; and in the tendency of the morbid process to become generalized, the constitutional character of the disease declares itself.

Perhaps for this reason it would have been better to have spoken of arterio-fibrosis as one of the diseases with multiple anatomical foci, and having a more markedly constitutional character, because in arterio-fibrosis there may be visceral alterations directly subordinate, or because in the individuals whom we shall consider in the picture of the diseases with multiple anatomical basis it will be necessary to mention a very interesting fact—namely, the production of connective tissue in the viscera, including the lung and kidney.

But as my only object was to state that though in some cases it, as a condition of morbidity, is diffused everywhere in the organism, in others, either on account of the favourable transformation of the latter, or of its better primitive organization, it is circumscribed to an organ or an apparatus, it has appeared to me more convenient to speak of arterio fibrosis, discussing the morbidity of the circulatory apparatus depending upon its morphological condition.

Elsewhere we have seen that the hypergenesis of the connective tissue in the viscera, and especially in the lungs, may be considered the effect of the progressive transformation of the lymphatic elements already predominating. Well, in this connection also, the facts which are met with in the *thin* of series (1) of the Third Combination in respect to the arterio-fibrosis deserve to be compared with those analogous occurring in some individuals of the First Combination, but transformed. The fibrous degeneration that is observed in some of these individuals testifies to the degree of relationship which unites them to the former, especially when they are attacked by gouty phenomena and by pulmonary symptoms during virility. I shall again refer to this question later on, when I discuss the relations that may exist between gout and pulmonary phthisis.

We have already seen that the organisms appertaining to the Third Morphological Combination are subject to diseases of the limbs qualified with the appellation *rheumatic*.

We have likewise seen that the individuals of series (1) are at an early age liable to joint affections in whose pathogenesis we see the rheumatic cause associated with the lymphatic nature of the affected parts. This is also proved by the fact that similar morbid manifestations are met with in individuals of the First Combination, in whom the lymphatic constitution is very marked during the early periods of life, though it becomes modified later by the final organic transformations.

Rheumatic diseases are also observed in the *thin* of series (2), but here they declare themselves differently. The acute forms prevail, and may, it is true, recur, but they quickly disappear.

If we consider attentively these facts, we must admit that in those in whom the morphological data of venous plethora are found, the lymphatic conditions which contribute to specialize the form of the rheumatic affection coexist in the tissues of some parts of the body. This is confirmed by the examination of the affected parts, in which especially the vascular apparatus, or, better, the venous network—*cæteris paribus*—appears more abundant. In some cases one observes the skin very thin, the so-called white tissues more rich, and sometimes also the articular ends, even before the beginning of the disease, slightly enlarged.

Analyzing the rheumatic affection in other clinical symptoms, we find that the urine contains a larger percentage of urates in some than in others, and that in the former it is in direct relation with the exacerbations or with the repetition of the rheumatic sufferings.

These coincidences, when one removes all other possible contingencies which usually render the urine rich in urates, such as errors in diet, excessive exercise, etc., are connected not only with the influence of the external environment, but also with the special morphological condition. In reality, the phenomenon is met with, as a rule, in the *thin* organisms of both series of the Third Morphological Combination.

The more marked the lymphatic elements in the tissues of the joints, the greater the tendency of the morbid process to chronicity. The disease sometimes extends beyond the limits of the parts comprising the joints, and invades the adjacent serosæ and the muscles.

If these conditions occur in organisms endowed with special erethism, then we see the nerves co-operating in the process, and meet with those cases which appear sometimes as if they were subjected to the influence of the spinal centres, both when they become worse and when they improve. The natural and strange deformities symmetrically distributed, the tendinous retractions, contractures, all are elements which show the influence of the nerves ; and alterations of the peripheral nerves are not wanting.

But if also with regard to this we wish to know more, following the criterion of morphology, we shall find that it is not sufficient for the rheumatic manifestations to be associated with a special nervous erethism, as it is necessary that they be favoured by the special nature of the tissues, and that the nervous system be subjected to the influence of particular circulatory conditions—that is to say, that the spinal circulation, owing to the known relations which exist between the central spinal vein and the prevertebral and hæmorrhoidal veins, undergoes oscillations that depend usually upon the mode in which the functions of the digestive organs and of the prevertebral circulation in general are performed. The presence of piles is not necessary ; whether they are present or not is the same. That which is important is the degree of endovenous pressure that exists in the prevertebral veins, consequently in the central spinal vein, consequently also an alteration of the spinal innervation on the circulation of the peripheral parts affected, which thus present corresponding symptoms.

This fact, though it can be demonstrated by physiological experience in every individual, and is important in proportion to the greater development and greater torpor of the abdominal circulation, has never been practically recognized as one of the agents that help to modify indirectly the spinal innervation. It has passed unobserved also when certain therapeutic results, such as the improvement of the symptoms following purgative and diuretic treatment prescribed without rational discernment, but following banal indications, have demonstrated in an undeniable way its co-operation in the development of the morbid process. Very frequently the teachings of Nature succeed in correcting errors or in illuminating the mysterious picture of the symptomatology.

From the above it will be understood that with the rheumatic manifestations of the limbs one can have cardiac, pulmonary, nervous, hepatic, renal, or other phenomena, even independently of a true organic affection, and that when these phenomena intervene they serve to open the discussion concerning some therapeutic provision which would never have been suggested, obtaining the indications for the treatment exclusively from the part affected.

All this agrees perfectly with the results of clinical experience. Since the rheumatic affection, whether it be acute or chronic, is associated with more or less marked constitutional lymphatic characters, it never constitutes by itself alone the cause of the sufferings of the patient. In the multiform varieties of the clinical manifestations, that which is met with morbid, besides the joint symptoms, is not exceptional, casual, nor is it depending on other cause, but is connected by morphological relations with the articular alterations.

Hence the reason through which the fundamental morbid facts, especially in the cases with a chronic course, are frequently seen to become aggravated or mitigated, together with the perturbation or restoration of certain organic functions, according to the law of functional correlations and the principle of homology.

Hence it is also that the treatment, though directed by identical fundamental principles, must in every case correspond to certain indications obtained from the knowledge of the individuality.

Inasmuch as our knowledge regarding what is called the rheumatic cause is still extremely limited, it is not possible for me to enter into further particulars of clinical practice ; but if, as it is probable we shall be able to do in the future, we could distinguish the rheumatic causes, or, at least, recognize a diversity of nature between the cause which gives rise to the acute manifestations which have relations with miasmo-infective influences and what occurs in a mild and slow form from the beginning, which would seem to be above all constitutional, though aided by atmospheric changes, then from the mode of action of both other arguments could be drawn for demonstrating more clearly the justice of these ideas.

Proceeding now to speak of the abdominal diseases, it is necessary to distinguish them into :

Diseases of the intestine.
Diseases of the liver.
Diseases of the kidneys.
Diseases of the female internal genitalia.

Diseases of the abdomen in general are frequently met with in individuals of the Third Morphological Combination ; nevertheless, one can observe in some more marked disposition to this or that disease than in others.

The maladies of the intestine are the most frequent, and are rarely accompanied by other morbid manifestations relative especially to the liver ; but from the greater or less participation of this are derived the criteria for differentiating the cases and recognizing the different morphological conditions.

In the *thin* of both series, in which we have studied separately up to now the organisms of the Third Combination, the intestinal affections are more frequent. The frequency, however, is maximum in the *thin* of series (1) and minimum in the *fat* of series (2).

One may perhaps remark that the *fat* also of both series present, or may present, intestinal sufferings, and this has been already admitted by me in the words which I have just written. To understand ourselves clearly, we must recognize the fact that it is one thing to demonstrate disturbances of the intestine, and quite another to have all the symptomatology of a formal disease of the intestinal tube. This is what, according to my observations, occurs more frequently in the *thin* of both series.

And here it is necessary to remember what I have said concerning the mode in which one proceeds for recognizing the development of the intestine, because not all the *thin* become equally ill, but by preference those in whom the bi-iliac diameter is greater than it should be in respect to the length of the abdominal cavity. If this be also met with in some fat individuals, it is an indication of analogous predisposition, and explains why in the course of other abdominal diseases they can present intestinal complications.

That which I have said of the disposition to intestinal diseases of the *thin* organisms pertaining to the Third Combination corresponds to what we learned studying the organisms of the First Combination, and if we now unite in a single group all these individuals who present a certain analogy in diseases of the intestine, we shall find differences which are in direct relationship with the morphological differences.

Meanwhile, in those of the First Combination, the signs of the lymphatico-scrofulous constitution are more marked ; they are less evident in the *thin* of series (1), and less still in the *thin* of series (2) of the Third Combination. One comprehends, therefore, that there may be morbid phenomena between the former and the latter having similar expression and course.

In those of the First Combination phenomena of abdominal plethora may be met with when the disease arises at an advanced age and the organism has been transformed in the mode which we know. These phenomena are constant and more manifest in the *thin* organisms of both series pertaining to the Third Combination.

The participation of the liver is least in individuals of the First Combination; it is greater and more constant in the others. If it occur in individuals of the First Combination, we shall find data in the form of the belly which denote the predisposition to the morbid fact—that is to say, the xipho-umbilical line excessively long, and, besides, data relative to the notable tension of the right half of the heart.

The resistance of the organism to the disease is less in the individuals of the First Combination; the intensity and duration of the symptoms are greater in the thin individuals of series (1) of the Third.

In those of the First Combination the participation of the lymphatic organs in the intestinal disease is not rare. In some cases it presents itself as a revival, in others it may have been latent—tuberculosis may declare itself; in others, finally, all this is exceptional.

Nevertheless, when the exception is met with, one sees morphological conditions which clearly demonstrate that the basis of the morbidity is the same—the predominance of the lymphoid tissues—and that all the nosological differences depend upon the different proportions in which the tissues are associated in the organization of the part; and if at the same time we examine the circulatory system of the part and the development of the mesentery, we shall verify, though in an unequal measure, an equal relation between the less concourse of the arteries, the greater concourse of the veins, and the development of the lymphoid elements corresponding to these disproportions of the two parts of the circulatory system.

With regard to the individuals of the First Combination, and to the *thin* of both series of the Third Combination, the facts exposed are so true that when I have to form a judgment on the intestinal affections with a chronic course, or which manifest themselves with regular exacerbations, I make a point to investigate if by chance the lesion of the intestine were not secondary, or connected with morbid facts developing in the mesentery. In such cases the most careful objective examination will not enable us to discover the glandular swellings ; but, on the other hand, the absence of causes that would explain the diuturnal sufferings, the pertinacity of these to all kinds of treatment, the constitutional condition of the patient, all lead us to conceive an order of morbid phenomena which develops in the dominion of the lymphatic tissues, and is favoured by the circulatory conditions of the belly. This is finally confirmed by the morphological data, and not rarely to confirm all this supervene distinct symptoms, pathognomonic of the disease of the mesentery, with or without the sequela of symptoms properly called peritoneal.

From my notes I can take very interesting examples, which I have been able to obtain solely because my observations have been conducted on this scientific line. They refer to certain morbid manifestations, having either the appearance of simple intestinal catarrh, or that of pure intestinal dyspepsia, always, however, accompanied by meteorism and borborygmi, frequent and persistent in young subjects, never hypochondriacal. The alvine dejections were often soft and fœtid, for the imperfect digestion left the alimentary substances a prey to decomposition. If there were a tendency to constipation, this was followed by colicky symptoms, turbulent discharges, and subsequent diarrhœa. The liquid stools contained mucus and lymphatic elements in abundance, and sometimes were passed pseudo-membranes in casts or small pieces, which constitute, as is known, a special form of chronic enteritis, in which the constipation alternates with diarrhœa. These and other local and general facts make one suspect the morbid cause to be of a decidedly constitutional nature. After a variable time phenomena supervened which explained everything, because they showed the alteration of the tissues of the mesentery or of the peritoneum, and in some cases one noted phenomena of the peritoneum and pleura. Many of these cases, which are not recognized when the intestinal symptoms are less intense, but by reason of their persistence require special treatment, from the result of the treatment are qualified for what they really are, or are seen gradually to disappear as the morphological conditions of the patients become modified.

In the *fat* of both series there may also be diseases of the intestine, but these have another character. Those already considered are specially connected with lymphatic manifestations proper ; these are, in my opinion, more mucous. In both intestinal catarrh is present ; but in the former the lymphatic cellular element predominates, in the latter one observes the production of mucus. In fact, here the hæmorrhoidal condition predominates. The colon is specially affected, and the enormous development and repletion of the venous system represent the anatomical fact determining the rest.

I wish to make another observation to avoid being misunderstood. I do not intend to deny the possibility in the *fat* of lymphatic affections proper of the intestine. My object is solely to note that which, in the majority of cases, is verified as the effect of the morphological disposition.

Besides, it is very well known that one must take into consideration many other causes which help to give rise to intestinal maladies, and by themselves alone suscitate corresponding morbid processes. These, therefore, find in the morphological disposition the motive for declaring themselves in one mode rather than in another. It is natural that, when one has to diagnosticate an established disease, one must value all the factors which assist in producing it, and then consider the local morphological causes and those which can influence it from a distance, and, finally, those derived from the general circulation, hepatic circulation, etc. Not to be one-sided is a precept suggested by morphology, and it is the guide that I have followed in instituting my observations.

Before concluding this argument, I must add something with regard to the organisms of the Second Combination. As we have seen, some of them diverge from the pure type of the Combination by reason of the excessive development of the abdominal cavity. In this consists the morbidity which the belly presents, and which varies according to the proportions of the diameters of the cavity ; and if, apart from the other causes which can influence the individual, we observe those individuals in whom almost spontaneously recur intestinal disturbances, we see that in them the bi-iliac diameter is excessive. But at the same time we note another fact of minor degree which, on the contrary, in the organisms of the Third Combination reaches a higher and maximum degree, and it is venous plethora. This in both must be considered not only anatomically, but also physiologically, in the sense that the blood-mass represents a complex of factors which influences the trophism of the histological elements, and of consequences in the functions of the organs.

As is readily seen from these comparisons, everything induces one to maintain that in Nature living things, especially the superior beings—man—do not readily lend themselves to a rigorous classification, and that the more distinct morphological varieties of some represent the result of modifications which gradually take place in others of the series to which they appertain, and that, also, the individuals artificially divided into series, owing to certain morphological characters, may more or less approach or separate themselves from those of another series if they be analyzed, not in their distinctive character, but as a whole.

We have taken into consideration the morphological factors predisposing to diseases of the intestine ; we have seen that in the disproportionate development of the abdomen the disposition increases according to the absolute and relative greater volume of the belly ; and applying this conception, we can conclude that the greatest disposition is met with in individuals of the Third Morphological Combination, and that in the other combinations it is greater or less according to the relative morphological varieties.

If we now extend our observations to the field of the symptomatology of the intestinal diseases, we shall find ourselves confronted by a considerable number of facts, all agreeing with the premises, and all formally expressing other morphological conditions, which in the single individuals constitute the reason of the clinical varieties. I alluded in part to this ensemble of things, showing the way through which some morbid complications generally and more easily manifest themselves ; but here I allude especially to the symptoms of the intestine—to the dyspeptic forms, intestinal excretions, the primary seat of the disease, etc. But all this will be more fully developed when I treat expressly of the special pathology.

With regard to the diseases of the liver, I wish first of all to refer to what I have said concerning the predisposition that the organisms of the Third Combination present as a rule for hepatic cirrhosis, and what I added for arriving at the conception of abdominal lymphatism as another morbid predisponent.

Predisposition to hepatic diseases may mean much or little at the same time. The diseases of the liver are very numerous, and the fundamental morphological conditions of the Third Combination have not yet disclosed the way for discerning a special disposition to this or that infirmity.

But for opening the door to useful practical considerations we are obliged also in this case to make distinctions. We must divide hepatic maladies into the *hereditary* and the *acquired*. Admitting the hereditability of cancer, biliary calculus, etc., the general morphological expressions acquire a more concrete value, and we can distinctly maintain that, for example, *in the descendants of cancerous parents, the cancer will manifest itself in the parts where the morphological note of lymphatism is marked.*

This has been confirmed by my clinical observations, and by means of the histories which I have obtained I can affirm as follows: Mother, dead from cancer of the liver, will have given birth to children who may present cancer either of the liver or stomach, or uterus, or breast, etc.; and if in every concrete case we search for the relations which exist between the seat of the cancer and the special morphology of the part, we shall find the above-mentioned coincidence—that is to say, *the cancer will have its seat in the midst of the tissues which present markedly the morphological note of lymphatism.*

It is not by chance that I have spoken of cancer in this place. Like the other diseases, cancer requires to be dealt with while treating of the Third Morphological Combination, because in the organisms which pertain to this combination one sees more distinctly the morphological characteristics to which their pathogenesis is connected, so that, when the same infirmities occur in organisms of the other combinations, one can more easily understand their etiology, and the investigation of the anomalous organization of the parts affected, and which before the morbid manifestation represented the places of minor resistance, the local morphological errors, is almost necessitated.

In my opinion, the predisposition to cancer is found most frequently in individuals of the Third Combination. This is in agreement with the anatomical results presented by Beneke, who refers clearly to that excess of development of the belly and that intense hepatic function (which I believe it better to call simply excessive hepatic development) which constitute, as we have seen elsewhere, the anatomical basis—or, better, the morphological basis—of abdominal lymphatism.

I cannot accept all that which Beneke considers as the anatomical basis predisposing to cancer, mentioning especially the liver, because, when this anatomical basis is considered thoroughly, it is nothing but that special ensemble of relations of development of the different vascular elements which, in my opinion, generates the predominance of the lymphatism ; and it is for this reason that I find also theoretically just that which clinical observation has shown me, and which I have mentioned. Then, again, with regard to the liver many things have to be said, as I shall have occasion to show in another place, before one will be able to recognize the part which it takes in the pathogenesis of cancer.

It is certainly not my intention to discuss the pathogenesis of cancer in general, but, having said what is the result of my observation concerning the morphological relations obtaining between the production of cancer and the condition of the organization of the part, I feel that for the present no definite conclusion can be arrived at with regard to this grave argument. Nevertheless, while we all can repeat the ancient and modern theories, and find fault with them, when we test them with the results of observation, we recognize that the few phrases suggested to us by morphology applied to the clinical question introduce us to an order of facts which must not be ignored if we wish to see all sides of the pathogenesis of cancer. That the future cancerous person may have a part of his body in which the lymphatic and kindred elements are predominating, and in consequence form a particular biochemical environment in which the tissues abnormally develop, till, by virtue of final dyscrasial reasons and of other etiological motives derived from the functional exercise of the organ, they end by deviating from the normal form, assuming that atypical special to cancer, cannot be said to be unfounded or opposed to the fundamental idea which is contained in the more accredited pathogenetic theories of cancer.

To me it appears that, when one wishes to proceed to the quest of a truth, it is necessary to do so according to a method which must be, not scholastic, but natural. Therefore, I find it necessary for me to arrange the matter to be studied in the best way, in order that the relations that exist between the multiple facts which constitute it may stand out immediately and clearly. Acting in this mode regarding this very difficult matter, I have noted relations which seem to me of some importance, like the following, which I have obtained from my statistical notes :

Cancerous individuals beget scrofulous, cancerous, and tuberculous individuals ;

Scrofulous individuals beget cancerous, scrofulous, and tuberculous individuals ;

From the family of scrofulous and cancerous individuals descend lymphatics, scrofulous, rachitic, and tuberculous individuals.

Without any exaggeration, I believe one can deduce from these facts that the special organization of the part which will be predisposed to the cancerous manifestation begins to be, morphologically considered, of inferior degree, of corresponding biological value, hence destined to a degraded life or an atypical evolution. From this wishing to proceed to more intimate knowledge, much more intimate than the histological expression of the elements which constitute the new production, it will be necessary to direct our study to the biochemical process of the primitive elements.

I cannot carry this discussion further, wanting the necessary elements for properly developing it and for bringing it to a useful conclusion ; but I believe I can truly maintain that the general morphological data, as well as the hereditary data expounded above, indicate the point of departure from which different morbid processes can evolve.

Returning to our principal argument, I can say that I have met with cancer more frequently in the *thin* than in the *fat* of both series into which we have divided the organisms of the Third Morphological Combination.

But it is advisable to recall the fact that the distinction introduced of the *thin* and *fat* is for convenience of description, and according to which the *fat* are those who reach obesity, the *thin* those who do not reach this point, but more or less approach it ; that, finally, the obese must be considered in a series at the extremes of which we have the maximum and minimum, and that the *thin* constitute another series also having its extremes. Therefore, the morbidity referable to the Third Combination expresses itself in a variable measure, while the individuals represent not distinct terms, but those of passage from one extreme to the other of a series, from one series to the other.

It remains for me to conclude with two clinical facts : the coincidence of cancer of the liver and hepatic cirrhosis, and the coincidence of cancer of the liver and biliary calculus. In this connection I have not sufficient observations. I have the suspicion that these two coincidences are found in unequal organisms; the former more frequently in the *thin* of series (1), the latter in the *fat* of series (2).

Biliary calculus as a hereditary disease coincides with the same morphological characters as cancer, and is met with more frequently in the *fat* organisms of both series. By virtue of analogous relations it is also observed in the individuals of the First Combination who have reached a remarkable degree of transformation through the development of the belly.

Diseases of the liver are certainly favoured by the special predisposition, but one must recognize the influence of many external causes. Be this as it may, the individuals of the Third Combination and some of the First who suffer from tuberculosis or heart disease are specially predisposed to affections of the liver ; they manifest hepatic symptoms also during other maladies, as I have mentioned. This must be always borne in mind, because the participation of the liver in other intestinal, uterine, cardiac, and pulmonary diseases gives to these a particular aspect, and influences directly the general state. To him who desires to distinguish the syndrome of *hepatic asystole*, all that which concerns the special morphology of the belly or of the liver will, if I am not mistaken, offer scientific data for the interpretation of the morbid phenomena, whose complex, as is seen, cannot present itself as a true nosographical form, it being instead a nosological fact connected with the individuality.

The influence exercised by the liver occurs so constantly that for being admitted in every concrete case one need not have recourse to the verification of the enlargement of the hepatic area by means of percussion, we having demonstrated that in such cases one must take into consideration not only the enlargement of the liver, but also its primitive development, the intensity of its function, the facility with which the internal pressure in the vascular system of the organ may be modified without a greater expansion of the liver necessarily taking place. In proof of this it is sufficient to give an example, such as the case of gastro-intestinal atony with catarrh of the digestive tract. This is a frequent pathological condition, but it may be met with in two individuals appertaining to two different Morphological Combinations ; he who pertains to the Third will show in a more constant and more evident way some alterations of the urine, which are due to the participation of the liver in the disease—darker colour of the urine, traces of urobilin, deposit of urates, indican.

To him who looks at things in an unsystematic manner, and in examining a patient usually follows some special initiative, these considerations will offer arguments for persisting in the initiative, by which he will be led to something useful for practice, when, owing to the facts observed and justly interpreted according to the principles of morphology, he tries some new therapeutic experiment. There is no doubt that from this point of view the most simple intestinal affection in different individuals does not always present the same indications ; and instead of prescribing this or that drug solely because it has been proposed for combating equal or similar symptomatic forms, or for going blindly in trace of its curative virtue, it will be possible to give the therapeutic experiment a more rational direction.

I have mentioned another fact which has some relation with the morbidity of the liver, and consists in the mode of development, and consequently of function, of the inferior vena cava. In vol. i. of *Clinical Commentaries* I have described all that which I have gathered concerning the pathology of this circulatory organ, and I refer the reader to that book. Here it will be sufficient for me to state that in diseases of the liver and other abdominal maladies with hepatic complications, we shall be able to comprehend the reason of the prominence of the hepatic symptoms from the examination of the venous circulation, which empties into the inferior vena cava.

To be convinced of this, one must not limit oneself to the observation of a single clinical case and pretend, as some have done, to find in it all that which he seeks, both as regards the speciality of the symptomatology and the anatomico-pathological finding. This would signify that one has not an exact conception of matters, and much less of the morphological method.

We observe, on the contrary, several patients suffering from the same disease; we exclude every cardiac complication; note the conditions of the liver and of the circulation of the lower extremities, and after having thoroughly ascertained the facts in many clinical cases, and suitably arranged them, conclude—

1. That the function of the inferior vena cava in some cases helps to augment the volume of the hepatic area, because, during the disease, the venous circulation of the lower extremities, and in general in all the venous province of the cava and only in this, is retarded, and if we make the patient stand up, we can also observe a greater turgidity of the veins than is usually met with. In some cases, independently of this and of every cardiac influence, a slight swelling forms around the malleoli, which some patients acutely indicate as a bad or good sign according as to whether it increases or diminishes, and disappears. In other cases we also observe diffuse œdema of the legs, of the lower part of the belly, in the abdominal walls.

2. That there are other cases, on the contrary, in which the volume or the engorgement of the liver is not connected with these modifications of the circulation of the inferior vena cava.

3. That the participation of the inferior vena cava in abdominal diseases—cardiac influence always excluded—is met with more frequently in the *fat* individuals appertaining to the Third Combination, and is due, above all, to true atony, to defect of contractile activity of this vein, and may also be due to nutrient alteration of its walls, it being true that in the different pathological contingencies the function and nutrition of this vascular organ may be affected.

4. That less frequently one observes in the *thin* the participation of the phenomena depending upon the inferior vena cava, and in them also its function may be altered in two ways: by the dilatation consequent on the loss of contractility, and by lesions of the walls of the vessel. This latter condition in the majority of cases must be considered as an exophlebitis, the adventitia being richer in vessels than normal, and covered by more abundant lax connective tissue.

I shall now speak of the more important *renal* diseases.

For me it results that nephrites are distinguished into those which affect the tubules and those which affect the interstitial substance. Among the latter it is necessary to distinguish those which arise owing to alteration of the interstitial connective tissue and those which are derived from previous alteration of the arteries, though this may become invading, and involve the interstitial tissue. According to my observations, tubular nephritis and the primary interstitial must be considered together for the pathogenic study in relation with the morphological conditions of the kidney, especially as we very frequently see them combined in mixed nephritis, and as such are met with in patients who have a different morphological type from that which—as we have seen when speaking of arterio-fibrosis—offers a substratum favourable to the other anatomical variety of nephritis. The former, then, have their natural ground of development in the lymphatic individuals in general. By reason of this the organisms of the Third Combination and, above all, those of series (1) from childhood are more liable to the disease. By reason of this, also, these individuals, every time the function of the abdominal organs alters in a durable mode, readily present real complicative phenomena.

With regard to tubular nephritis and the mixed form, it is necessary to add that, like hepatic cirrhosis, they may also begin and develop independently of external causes. This occurs especially in children. In adults and children, even when the external causes have acted, these will have found in the organism greater organic adaptation for feeling their influence. All the patients observed by me have presented marked notes of abdominal lymphatism in general, but particularly those whom we have described as having disproportionate development of the inferior vena cava and greater endovascular pressure.[1]

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[1] A practical example will not be out of place. A young man fell ill of nephritis, and a colleague who saw him thought that the disease was due to the specific *violani* which the patient had used previously to taking to his bed for expelling a tapeworm. *He had all the morphological attributes of the abdomen of which I am occupying myself*, and from their valuation I was led to anamnestic investigations, *which placed beyond doubt that the usual affection had existed in a very mild form for some time before taking the drug.* How could the specific *violani*, and he who advised it, have caused the disease, when in reality this was aggravated by disorders which were disclosed by the anamnesis and duly valued by the morphological examination ?

It is needless for me to quote cases of amyloid degeneration of the kidney, because daily experience confirms what I have said ; but I will mention all the renal complications that are met with in the course of many diseases even outside the abdomen, such as pneumonia, or general diseases, such as typhoid fever, etc. In all these cases, taking into consideration the specificity of the causes, the more pronounced nephritic phenomena occur in the organisms which have the most marked characters of abdominal lymphatism.

I present these things not as ideas or reasoned conclusions, but as facts that I have verified also on the anatomical table whenever in the cadaver I have been able to confirm the coincidence of renal alterations with the morphological data on which, in my opinion, the morbidity of the organ depends. Hence I refer to the more or less marked aplasia of the aortic tree, to the greater or less hypertrophy of the left ventricle, which is derived from it, and which must not be considered as depending solely upon the renal disease ; hence I refer also to the marks of the past sufferings of the lymphatic system, to the disproportions in the development of the large abdominal veins, the richness of the lymphatic tissues in the mesentery, the big spleen, which in some cases exists, but not, however, as the indication of secondary lesion. All this constitutes a considerable number of facts which always pass unobserved, or, if they be observed, are always looked at from the point of view of different theories, never from that of modern pathology. And it is strange that there are still those who call the facts of morphology, and the morbid coincidences which depend upon them, hypotheses !

With regard to the diseases of the female internal genital apparatus, it is necessary to distinguish those of the parovarium, ovary, and uterus.

Although all these find in the type of the organisms pertaining to the Third Morphological Combination the ground suitable for their development, we see that chronic parenchymatous nephritis is more frequent in the women who belong to the *thin* of both series.

Further, all the forms of metritis find their predisposition in abdominal lymphatism, especially of the organs contained in the pelvis. Very frequently we see them influenced by abdominal plethora, and many symptoms of metritis, including the losses of every kind, indicate the special conditions of the hæmorrhoidal circulation.

In the *thin* women of series (1) the more pronounced the characters which resemble those of the First Combination, the more pronounced the simple catarrhal metritis of an irritative nature, with greater or less participation of the tube and the ovary. In these, as well as in those of the First Combination, examples of tuberculosis are met with ; in these the examples of salpingitis following parturition are relatively more frequent than in the others of the Third Combination.

In these women, always owing to the morphological conditions mentioned, during pregnancy lymphatic engorgements due to the changed circulatory conditions of the belly may take place in the peritoneal folds, which in some cases are favoured by the functional anomalies of the intestine, especially obstinate and habitual constipation, associated with, as often occurs, abuse of alimentation. The turgid state of the peritoneal folds following parturition may readily disappear, but in some cases it constitutes the favourable moment for the onset of irritative phenomena with a subacute or even a chronic course, which gradually give rise to grave abdominal sufferings more or less extensive, and which declare themselves with hardness in the belly, and other symptoms, such as those of an heterologous new-production or of tuberculosis. But they can be differentiated by certain data which cannot be indicated or discussed here, and by their course and result, which is that of resolution. I believe firmly that this constitutes an important point of gynecology.

Some years ago I published *Gynecological Notes*, in which I gave not a few facts which tended to show what I now announce in a formal way. These refer to uterine diseases, including vaginal catarrh, which are erroneously considered as local diseases, or are treated without regard to the local morphological conditions. They are diseases which may be called constitutional ; the causes to which they are attributed do act, because they find there the predisposition that I have mentioned ; but the treatment never succeeds in its scope, because it does not combat the influence of the special Morphological Combination.

In the women who appertain to the Second Combination the morbid dispositions are less in proportion to the purity of the morphological type, and when uterine diseases start in them, it is certain that they must be attributed especially to external causes. Accustoming ourselves to consider the genesis of uterine diseases in relation with the pre-existing morphological disposition, we shall estimate more precisely their complex clinical expression and the reason of their course ; and with regard to the treatment we shall know how to extend our initiative according to the special indications of the case, profiting by some physiological factors very often neglected.

I cannot discuss here the influence, which is sufficiently known, that the nervous system exercises, and undergoes in diseases of women. But from this knowledge—which is the essence, so to speak, of common observation—I pass on to mention that also regarding this point of pathology we must not profess systematic ideas.

If one frequently see alterations of innervation in many, but not in all, cases following disturbances of the female genital organs, one not rarely sees particular states of innervation expressing themselves also with phenomena of uterine sufferings, and diseases of the uterus without the nerves feeling any consequences from the latter.

These three orders of facts are not always in relationship with those particular morphological conditions of which we have been speaking up to now. To comprehend the individual cases in their true physiological manifestation, one must make a minute analysis of the nervous system, following the lines elsewhere mentioned in these pages for verifying the *neurosis*. In this connection I would refer the reader to my book, *Neurosis and Neurasthenia.*

The uterine malady may be associated with hepatic, gastric, pulmonary, cardiac, cerebral, or spinal phenomena ; and the assertion that all are reflexes, and the assertion that they express instead a complication, are equally maintained. In fact, these phenomena in some cases are determined by the mechanism of the reflexes, especially when the most marked attributes of so-called nervousness exist in the organism ; while in others they represent true morbid complications ; and in others still the play of the reflexes may be seen acting among these variously and recurrently. But, as a rule, the physician does not note everything for discerning when the phenomena complicating the uterine disease have one or another origin: some explain all, admitting the complications, others see the cause of everything in the nervous system. Nevertheless, he who will look at things more closely, making the necessary application of the morphological criteria, will find a little of right and a little of wrong attributed to both.

In reality, according to whether the uterine affection is found in an individual who participates in the notes of the First Combination or of the Second, one finds, besides the phenomena of the fundamental disease, those which are special to the morphological combination, and represent the effects of the functional correlations between organs and organs—effects which, according to the mode in which the nervous system responds to the influence of the uterine disease, organize themselves in one way or in another.

An example will render more clear this idea, which is derived from experience.

We have before us a woman who pertains to the *thin* of series (1) of the Third Combination : excessive development of the belly ; the thorax, on the contrary, approaches that of the First Combination ; the heart *idem ;* in the past existed transient lymphatic manifestations ; in her family were cases of tuberculosis ; during the course of the uterine disease thoracic symptoms manifest themselves—cough, vague pains, and some hæmoptysis—all this in the midst of hysterical symptoms.

Some will judge this case as an expression of hysteria ; others, on the contrary, will see among the hysterical phenomena a disease which threatens the life of the patient.

Well, the phenomena of the chest, independently from the hysterical affection, can be met with, and can be verified also in the man who presents the same morphological conditions. In the man, and in the woman suffering from uterine disease, they are the result of the accentuation of circulatory conditions, which are primary, but remain latent, till at a given moment they are influenced by an accidental weakening of the cardiac function, or by some other kind of alteration in the hydraulic conditions. And if the cardiac function, above all—in the man owing to the effect, for example, of stomachic disturbances, in the woman owing to hysterical manifestations—is unfavourably influenced by vasomotor reflex phenomena, it will without doubt lead to symptoms of circulatory alteration in the thorax—more or less grave hyperæmia—and to corresponding phenomena, as if a new disease had arisen.

But, analyzing carefully the physio-pathological process, one must admit that these symptomatic manifestations are based, on the one hand, on a real morbid predisposition, and, on the other, on an anomaly of innervation, and that it would be erroneous to attribute all the importance to one rather than to the other. The scientific reason most conformable to the natural law requires that one must know how to recognize the part which the different elements play in order to form the complex biological phenomenon. Very frequently it is necessary to admit that it is the method of reasoning, and not the science, which errs or is wanting.

We shall now consider the *diseases due to anomalies of metabolism.* To these appertain polysarcia, gout, diabetes, oxaluria, and phosphaturia.

The adult organisms of the Third Morphological Combination may be affected with these maladies, or, to speak better, these are the organisms which present the predisposition to them. I have already referred to this elsewhere ; now it is necessary for me to enter more fully into the knowledge of the morbid forms, which originate from the individual morphological variation. This I shall do especially for obesity, gout, and diabetes.

I have said that one must distinguish from true polysarcia the corpulency which sometimes reaches the degree of true polysarcia in certain individuals who, by transforming themselves, escape pulmonary phthisis.

This is the reason through which some obese individuals suffer from frequent or habitual catarrh of the respiratory tract ; others have not only the venous networks and circulatory phenomena of the legs depending upon varicosities of the veins extremely visible, but likewise have the hæmorrhoidal condition predominating ; others, on the contrary, with the corpulency present a certain vigour and normality of the respiratory and circulatory functions which excludes them, unlike the preceding cases, from the necessity of a special treatment beyond that for the polysarcia.

In the first we find a heart orginally small, which has increased in volume, especially as regards the right ventricle ; hence the more ready phenomena of cardiac weakness, of dilatation of the heart with consecutive effects in the head, chest, belly, or extremities depending on the conditions of development which the venous system has reached in these parts. Further, some, in whom the system of the vena cava superior is more turgid than that of the vena cava inferior, are, as a rule, troubled by headache, frequently feel drowsy after meals, when the heart feels the depressing influence exercised by the full stomach. In these individuals, in the course of time, by the increasing venous stasis, are prepared those apoplectic manifestations which are associated with diffuse venous stasis, with or without serous effusion. These phenomena are not always so intense as to kill the patient, nor do they leave him absolutely powerless ; but though they are relatively easily combated by the resources of the art, they readily recur. When, on the contrary, the venous stasis predominates in the province of the vena cava inferior, gastro-hepatic, renal, hæmorrhoidal or vesical symptoms prevail.

The second may reproduce all the phenomena just mentioned, but with more marked accentuation of all that which appertains to venous plethora.

The third begin to suffer when, by reason of age or the neglect of hygiene—one must never forget the tendency which these individuals have for the pleasures of the table—the symptoms of weakness of the heart begin, and which are followed by those of granulo-fatty nutritive alteration and those of dilatation. This condition, as is natural, may accelerate or aggravate the morbid conditions also in the preceding cases.

I have mentioned elsewhere that in these individuals alterations of the central and peripheral arteries may likewise be met with. Consequently, when they exist, they render the symptomatology more intense and grave in that part and in that form which we have seen is predisposed by the individual morphological variation.

This note shows that when one begins the treatment of obesity, and pretends, before recognizing its morphological form, to discuss the advantage of adopting one or another therapeutic method, one ignores a question truly scientific ; that when a polysarcic individual presents certain circulatory phenomena, and one applies without discussion the maxim that they are due to a fatty condition of the heart, one announces simple hypothesis, but observes nothing scientifically, inasmuch as there may be in one case dilatation without degeneration, in another dilatation following degeneration ; and these anatomical conditions differ from one another according to whether the heart was orginally of the type of the First or of the Second Combination, according to the hygiene and to the functional state of the liver. This, agreeably to the data obtained from clinical experience and to the criteria derived from comparative anatomy and physiology, *cannot be considered equal anatomically and physiologically, and in consequence pathologically, in all individuals, where one sees prevail the preparatory function of the bile, or that reductive of the albuminoids, or the glycogenic function*, etc. This fact enjoins physiology and the clinic to discover a method for the verification of these functional variants which are necessarily in relation with the relative constitutional variants, as I believe I have clearly shown in my memoir entitled *Liver and Constitutions* (see *Atti* del *R. Istituto Ven. di Scienze Lett. ed Arti*, March 14, 1904).

The diabetic and gouty individuals must be classified precisely as we have done for the polysarcic : those who originally had the thorax resembling the type of the First Morphological Combination, and those with the thorax the type of the Second.

From this is derived the opinion that the former are *thin* diabetic and *thin* gouty individuals, the latter *fat*. And in both the hepatic function requires new investigations to have a just interpretation of the metabolism, of certain morbid phenomena, and of some curative methods.

Both, besides the diabetes and the gout, present other morbid facts inherent to the special morphology. Clinical experience, which induced me to trace out the cause on which the different forms of these diseases depend, fully confirms my assertion.

Therefore we can maintain that, always starting from the data of the Morphological Combination which is met with in individual cases, what has been said in respect to polysarcic individuals is applicable to the diabetic and gouty.

I have already mentioned cases of gout and tuberculosis ; now I shall refer especially to those diabetic and gouty individuals whose thorax originally presented the form of that special to the First Combination.

It is useful to know this, because it enables us to place in their true position the questions relative to the pathogenesis of the complex forms just mentioned. One cannot say that diabetes leads to tuberculosis in a general way, just as one cannot deny that a gouty individual may have had precedents relative to pulmonary consumption, or before dying may have symptoms of this disease, and even tuberculosis.

In fact, the morphological basis predisposing to diabetes is in the abdominal cavity, according to the type proper of the Third Combination. To this are associated other physiological factors relative to the cellular process and to innervation ; but the individual who becomes diabetic has other attributes inherent to the morphological conditions of the thorax, which in some resembles that of the First Combination, and conserves more or less its marked morbid tendencies ; while in others the thorax corresponds to the type of the Second Combination, and naturally contains very different morbid dispositions.

According to these ideas, which I have deduced from clinical observation, the statement which corresponds to the reality of the facts is not that made above—namely, that diabetes leads to tuberculosis—but this : that *diabetes may end in tuberculosis in those individuals who in their Morphological Combination exhibit the characteristic notes of the First Combination as regards the thorax.*

In those who have not these special notes the diabetes does not lead to tuberculosis ; the disease presents a number of accidental symptoms corresponding to the different morphology, and already indicated elsewhere.

These considerations also apply to the gouty, and in this uniformity of things is found a very important argument for discussing the question concerning the pathogenic relations which obtain between obesity, gout, and diabetes.

The common morphological foundation is the lymphatism, above all, in the exceptionally developed cavity of the abdomen ; the anomaly of the digestive process considered even in the cellular elements is special to each of these diseases ; the morphological factors capable of inducing symptomatic variants in the morbid picture of each malady is, first, the special functional capacity of the liver and of the kidneys, secondly, the type of the thorax. The common morphological foundation must be investigated for discovering the cellular biochemical process, by means of which one verifies the hereditary transmission of the disposition of a gouty individual to obesity, of an obese individual to diabetes, and in the same individual the presence of diabetes and gout, of obesity and uricemia.

Dealing with the Third Morphological Combination, I have touched many sides of clinical pathology, and I could extend this investigation were it not that I am afraid of passing beyond the limits of this book, which is only the general part of the work which I have conceived.

Here, therefore, I must stop ; but I wish to put in relief that in the three Morphological Combinations are epitomized, so to speak, the formulæ of all the possibilities of the chief general morbid processes. This will be readily understood, when one considers every combination as a series, whose extremes insensibly modify themselves to enter and make part of the other series.

I have spoken especially of the diseases which have their causation in that which is usually indicated by the name *constitution.* But here and there I have not failed to indicate that also the recurrent diseases may have their etiological cause in the morphological variations ; thus, likewise, I have not failed to mention how much therapy can be inspired by the knowledge of the individual morphology.

I believe, therefore, that if I have not succeeded in giving a full and perfect demonstration of my task, I can at least hope that I have—following rigorously the fundamental scientific principles—measured its importance, and that *I have justly inferred the necessity of a scientific formula with which can be expressed the conception of the different morbidities, which will be more profoundly studied, but which, up to now, I am bold enough to consider as a new promise for the future of our science.*

CONCLUSIONS

The importance of morphology in the dominion of medicine counsels one not to undertake the study of pathology without having previously acquired a sound and extensive knowledge of comparative anatomy and physiology and of embryology. Having placed these as the scientific foundation of the study of general pathology, and the theories of morphological pathology as the scientific basis of the clinic, the problems which will gradually present themselves for study will be suggested by the principles of causality, according to the order in which the physiopathological phenomena naturally succeed. They will be formulated according to the scientific criteria equal for all, and will be solved following the experimental method most in accord with the combination of the factors which concur in the production of the phenomena.

The history of medicine may be said to be the history of the errors of the medical doctrine—errors of method, errors of reasoning.

Hence the facts which spontaneously presented themselves for observation received from the different scholastic views a signification always hypothetical; and those experimentally produced received momentary importance for a scholastic demonstration which successively has not been always recognized, owing to the mutability of the method. Consequently, many facts have been forgotten and confuted in homage to the theoretical premises. But history and tradition have registered them, and now they are found in the midst of regions little explored of the knowable as so many landmarks which later will be included in the order of facts which the science is gradually co-ordinating as it discovers their connection with others of ancient or recent discovery. Then they will acquire their true and exact signification.

Therefore, although one cannot deny the progress of our science, one must admit that the progress has taken place in fits and starts, without order, without coherence of views, and, looking at things as a whole, one can justly say that the scientific movement has not always followed the true naturalistic method.

The method of observation, the experimental method now and then adjusted to the natural method by the able intuition of the investigator or by chance, has never been subjected to the rigorous laws of the science. But it will be, following the inspiration of the fundamental principles of morphology ; and as the method will be thus disciplined, it will become universal and enduring.

The reasoning was nearly always wrong, because it started from scholastic premises ; consequently, illogical but dialectical. It arrived at a dialectical conclusion, not at logically foreseeing the natural fact, or at pre-establishing the way which would have led to its discovery.

Morphology, with the laws on organization, with the principles of evolution, of correlations, of transformation, teaches us not only the method of observation and of experiment, but also the philosophical principle and the logical method of reasoning, which necessarily will be equal for all, because the *premise*, instead of being an emanation of this or that theory, will be constituted by the morphological—that is to say, the anatomical and physiological—datum from which it must take its movements.

Morphology will no longer permit the pure anatomist or the pure physiologist to found on a simple anatomical or physiological hypothesis the explanation of the phenomenon which, in its simple anatomical and physiological expression, represents the result of multiple morphological factors ; but it will appeal to both to contribute with the true facts of observation to the biological doctrine of the phenomenon in question. Neither will it consent to the pathologist's restricting himself to the particular phenomenon either produced in the laboratory or observed in the clinic, but will induce him to put the phenomenon in natural correlation with all the others of the organism and of the environment.

One will proceed with greater confidence to the acquisition of new knowledge, which will contribute to the morphological doctrine, but will not serve so readily to invent new theories that experience proves fallacious, owing to their having been conceived under the inspiration of scientific detail.

If I am not mistaken, from the day in which the principles of morphology will be generalized in the dominion of medicine a new era in the history of our science will begin, and which will be called the *era of morphological medicine*—that is to say, the transformation of medicine into true biological science.

The newly-born infant has still in him morphological signs which record better than in the subsequent periods of life the influence of the phylogenetic factors in the development of the being. And this may have reached maturity in a uniform degree or not in all its parts.

The exact knowledge of this must be the basis of the hygienic programme, which from the earliest days and subsequently will be directed to modify the growing organism for bringing it as near as possible to the ideal type.

This programme will take note of the disproportions of the parts, in order that with time they may be rectified.

And the method with which one will proceed to the scope will consist of two fundamental parts—alimentation and physical exercise.

The former—according to the cases—must be such as to favour the nutrition of some parts, the hypernutrition of others, the hyponutrition of others still; such as to repress the manifestations of lymphatism considered in its widest signification, because this condition, owing to the law of organization, exists more or less constantly in the newly-born infant.

The latter—physical exercise—will be wisely directed for stimulating the functions of the organs of animal life, so that their harmonious development will be favoured in order that they will concur in the better proceeding of the trophic phenomena.

The nutrition and physical exercise will thus succeed in modifying the internal environment and at the same time in rendering the organism more capable of resisting the influences of the external environment and of drawing greater profit from it during the various phases of its evolution.

The hygiene of the infant and the child, such as is practised at present, does not correspond to the above-mentioned programme, because it is dictated by physiological criteria mostly theoretical, without regard to the individuality, or is formed on some empirical precepts and on several prejudices.

On the infant, the child, and the youth hygiene exercises its most efficacious therapeutic virtue. *The hygiene of the infant, according to the principles of morphology, is equivalent to the preventive treatment of some diseases of adult age,*[1] *as well as to the improvement of the human species.*

The conception of the individual constitution is obtained from the individual Morphological Combination.

Every constitution is influenced in a particular mode by the nervous system.

Having established the conception of the general constitution of the individual according to the rules of morphology, one must recognize above all the constitutional note of the part in which the special morbidity resides; and, besides the verification of the functional expression of the general nervous system, one must search for that which is special to the nervous function of the part.

If with this we hint at the old doctrine of *constitutions* and *temperaments*, we do not for this reason intend to recall it to life such as it was in its doctrinal conceptions. We wish, instead, to indicate the way which leads to the verification of the anatomico-physiological factors—vaguely perceived by means of empirical observation—which create the *constitution* and its *varieties*, and the *different individuals*, while the expression of the morphological factors of *special morbidity* presents itself.

The excess and defect of development of the organs which compose the body, and of the tissues that compose the organs, are the fundamental factors which give rise to the different constitutions of the organism and of its parts. The lymphoid and connective tissues, the vessels, parenchymatous elements, nerves, in the measure with which they concur to form the part, determine its constitution, its special morbidity. The heart, the arterial and venous systems, the lymphatics, lungs, liver, spleen, intestine, mesentery, and kidneys, in the proportions in which they concur to form the body, impart to it a particular form and a relative morbidity.

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[1] Among them figure first and ominously scrofulosis and tuberculosis. Although tuberculosis is to-day included among the infective diseases, and the desirability of isolating the tuberculous with a hygienic scope is inculcated, I repeat that hygiene would gain not a little if institutions were erected for receiving those predisposed to the disease, in which they could be brought up according to definite rules, and thus physically transformed. The tuberculous individual is a *fait accompli;* the predisposed is a possibility. The means of the art do what they can against the disease; but hygiene—or, to speak better, *preventive medicine*—without doubt, wisely practised, would combat many possibilities. If these conceptions are not fulfilled, I am not diffident in prognosticating that the isolation alone of the tuberculous will remain an expedient very inferior to the high scope of social redemption.

Since I wrote the above ideas thirteen years have elapsed, and experience has confirmed them, so that one can say that the reason and method of the *campaign against tuberculosis* have conformed themselves to them.

External environment and organism exercise reciprocal influence. Consequently, giving due credit to the individual morbidity derived from the special morphology, one will not attribute to the environment alone more than the part which belongs to it. Hygiene and therapy will find in this new material for study and several reasons for correcting many treatments in order that they may become truly salutary.

While the evolution of the cellular elements of the organism is taking place, many of these cellular elements retrograde. *Evolution and involution, regression of the cellular elements, are phenomena which vary in individuals according to their constitutions or to the morphological type, considered in the whole organism and in its parts.*

The process of regression of the cellular elements is the cause of the appearance of bioblasts in the midst of the organs and tissues, which may eventually fulfil special functions, whose product will modify the organic environment.

To this phenomenon of regression of the elementary morphological organs must converge the studies which contribute to the doctrine of the pathogenesis of many infirmities. One must know, then, in what modes the external and internal environments co-operate in the production of these. I allude to miasmatic, infective, auto-infective diseases in general.

The relations of development of the visceral cavities—thorax and abdomen—in respect to the skeletal height indicate that excess and that defect in the evolution of the parts just referred to. Therefore, by means of suitable measurement of the body, one can arrive at the knowledge of the development of its parts.

Having acquired familiarity with the question by means of the careful measurement of the organisms, the methodical and accurate inspection of the body will lead to a judgment which is easily seen confirmed on the anatomical table in the cases of death. This, which is called the *practised eye*, can be acquired only by long methodical observation.

The method of measurement proposed is not a corollary from preconceptions, but the result of infinite and patient observations and comparisons between the somatometrical datum and the physiological and pathological fact. The rigorous control of all that which recently has contributed to the morphological doctrine in my institute has fully confirmed the positive value of the somatometrical verification which I have proposed.

The great circulatory system, considered morphologically, contributes potently and perhaps principally to the special organization of the being, and with its modifications during autonomous life, it co-operates in equal proportion in the changes which the organism presents passing through the diverse periods of life.

Therefore, with the measurement of the body, while one aims at recognizing the relations of development which exist between the stature and the visceral cavities, one implicitly establishes the relations of development between the viscera and the relative circulatory apparatus.

In every case the results of the measurement must be combined with the knowledge as exact as possible of the development of the heart. Hence the scientific value of the morphological examination of the circulatory centre.

The rigorous application of these precepts demonstrates experimentally that every individual represents a morphological variation of the type *to which the anatomical and physiological averages cannot be applied.*

It demonstrates also that the analogy of the Morphological Combination of some individuals affected by definite diseases with the Morphological Combination of others suffering from other diseases differently named indicates the unity of the morphological factor, which is the basis of the diseases in both the former and the latter. Inasmuch as the seat and extent of the morbid manifestation vary, consequently the morbid form will vary accordingly ; but the morphological substratum and the intimate nature of the disease are the same.

In reality, every Morphological Combination can be referred to a series of individuals who at the extremes are seen gradually to acquire notes resembling those of the other Combinations. This is observed especially in the individuals pertaining to the First and Third Combinations, in whom we see the connective and lymphoid tissues presenting themselves in different guises as the morphological basis of the many forms of morbidity.

And this is in agreement with the principles of evolution and with experience, it being known that while some connective and lymphatic and lymphoid tissues are the least advanced in evolution, *they are nevertheless always influenced by the general nutrition of the cell and of the organism, and are the most capable of being transformed.*

The morphological diagnosis must precede the clinical diagnosis, not only because it enables one more conveniently to value all the factors producing the disease, but also because it provides arguments which control the anamnestic researches, and helps one to comprehend the mechanism of the symptoms and the reason of their mode of expression in the concrete case, so that the evolution of the disease and its clinical variety become clear.

Just as morphology can be considered, so to speak, the geocentrical point from which the phenomena of human pathology must be studied, so the therapeutic precepts directed to modify the constitutional diseases, besides certain symptoms that owe their origin or their severity, not to the morbid cause, but to the special individual pathology, must have their principal foundation in it.

Preventive medicine, which must protect the individual from the diseases for which he shows a definite disposition, will be a corollary from the doctrine of pathogenesis ; and the hygiene of the individual, according to the principles of morphology, will dictate the precepts adequate to the special morphological condition.

To the naturalist-physician belongs a grand initiative also in many social questions for removing prejudices and for reforming institutions, beginning with the educational ones.

APPENDIX

THE FUNCTION OF THE GENERAL MEDICAL CLINIC IN BIOLOGICAL INVESTIGATIONS

The laity, as well as the students and the learned of the science, have doubts concerning the general medical clinic—doubts which are confined to no country, because they are met with everywhere, and are almost sanctioned even by the practitioners of medicine, who for this reason especially are the cause of the prejudices and errors which contrast with the progress of general culture.

It is required, and justly so, that the scientific foundation of the general medical clinic should be that of the natural sciences, but they end by confining it to the purely professional field with a logic which I do not know how to qualify. They demand of it studies and investigations indispensable to the advancement of the biological doctrines which concern man; but indirectly they deny to it the capacity of accomplishing them, because they misunderstand, or do not wish duly to appreciate, its experimental method for the biological investigations which necessarily belong to it. History tells us whether, and to what extent, the facts obtained by the general medical clinic contribute to the biological doctrines, but they wish it relegated to the disciplines exclusively applicative.

Further, while they do injustice to the experimental method proper of the clinic, in the impetuosity of modern experimentalism they do not suggest but demand that it should be incorporated with the rich harvest which the auxiliary sciences have gathered in the prodigiously prolific field of their experiences. The prudent reasons that the clinic would offer are condemned as scientific anachronisms, or as proofs of insufficient knowledge. Thus they have reached the point of discrediting a branch of biology, arduous and vast, inasmuch as the field of the general medical clinic is rugged and changeable.

In the midst of all this we see another phenomenon among the workers of the medical clinic. Some of them, believing everything gold which is offered them by the experimentalism of the other scientific branches, adore it, nobly aspiring to the purest satisfactions of the science ; others, almost wrecked, abandon themselves to the waves in search of fortune ; others, forgetful of the high positions to which they were called, concentrate their minds in one or another professional speciality. Thus, the autonomy of science offended, this divided into parts, only a very few remain firm to its splendid traditions, certain that the doubts and errors which assail it will cease.

This state of things is the product of various factors. The most notable are : the scholastic regulations in force ; the systematic abuse of experimental technics ; the conventionalism which obtains in the method of observation and of reasoning ; and, finally, a kind of degeneration of scientific discussion, by reason of which we assist, as it were, at the spectacle of a struggle for existence between some disciplines of medical science.

Duly to discuss each of these factors, bringing forward the historical and scientific proofs, would be too long, and would oblige me to cite and comment on things already known, though put aside, owing to deplorable acquiescence. For this reason I shall confine myself to recording briefly that which I deem most opportune for making work of reparation, however modest, to the injured dignity of the general medical clinic.

The scholastic body of the medical faculties in general is formed in such a manner that it serves contemporaneously for scientific and professional education. The professor of general clinical medicine must therefore aim at both scopes ; but he finds himself in the midst of difficulties and anxieties of different nature. He knows that it is not possible for him to overcome them bravely, as he would like and even ought to do. The student, ignorant of what best leads to the scientific scope and to the professional scope, imbued very frequently with the doubts above mentioned, sees but one scope—to take as best he can a little from here and a little from there, and prepare himself for the examination.

The final result we know : the future practitioners leave the

University, but they are not physicians; the future teachers of general clinical medicine must retake the path already travelled, to strengthen themselves in the study of the elements, without which they will not be able to begin the conquest of the higher culture.

In all this are included many questions, some of which concern the expository method of the scholastic matters, while others are derived from the false principle of the scholastic regulations, in virtue of which the general medical clinic cannot be united, as regards the part that belongs to it, to the group of the sciences expressly called *biological.*

It is necessary that the legislator, less exercised by the mania of reforming and more dominated by the true genius of the reformer, should introduce into our institutions that wise attitude which in itself is the creator of science, as it can be the most efficacious educator of able physicians; and meanwhile I maintain that *the systematic exclusion of the general medical clinic from the fellowship of the biological sciences is contrary to the reality and to scientific interest.*

The past, present, and future of the clinic protest against the legend that the general medical clinic is purely practical and professional. If it open the path to professional practice, it does not cease, for this, to contribute to the very high aims of biology. If from observations and experiments on nature—and in the case of the clinic one must say *human nature*—are drawn conceptions, rules, laws, in order to compose the art of healing, chemistry and physics also, from special observations and experiments, obtain precepts which serve for the arts and industries. Because there are an industrial chemistry and an industrial physics, this does not mean that there are not sciences purely practical, both chemical and physical. I add that a great part of those practices from which the humanitarian intention of the clinic arises does not constitute in reality an art, save as regards its humanitarian end; while if one considers those practices in the scientific conception from which they start, and in the scientific method with which they develop, and in the result, not humanitarian, but naturalistic, at which they arrive, and *from which can be obtained facts, conceptions, corollaries which connect themselves directly with the biological principle as history teaches,* one must recognize that precisely at that moment in which the action of the general medical clinic seems to the laity and to those not seeing a pure art—one must recognize, I repeat, the continuation of its scientific function. In the clinical institute the task of the *treatment*, the so-called art, is nothing but a scientific experiment. This naturally does not mean that all the treatments which physicians carry out must be regarded as scientific experiments. But the detractors of the clinic put everything in a bundle, not recognizing that among the *physicians* and in the doubt—whether in good or bad faith generated—are found the most common sources of accusation against that very noble and very difficult part of the science which can be studied only in the clinic with adequate method, with technicality, and special culture.

If the general medical clinic borrow from the sister sciences ideas and methods of research and of examination, it gives in return the results of its laborious experiments and facts which sanction, correct, or refute the hypotheses introduced into its highly biological field. What would astronomy have been without the assistance of the auxiliary sciences ? If physics had not invented lenses, the anatomist could not have become microscopist. If physics had not lent the pile to chemistry, the very important modern investigations on electrolysis could not have been begun. If comparative anatomy, if the many subsidies of physical and chemical technics, had not come to the assistance of general physiology, could this have made so much progress ? And if general clinical medicine had not brought to these its own special contribution, it would have remained almost mute, or very uncertain, concerning many phenomena of human biology. Hence one can justly conclude that : *All the clinical observations conducted with scientific method and with a scientific scope give results which contribute to the solution of the questions discussed regarding some biological laws* CONNECTED WITH MAN.

This is indicated with indelible characters in the history of the science, and clearly demonstrates that the general medical clinic and its method of scientific investigation respond to the high scope to which they are directed, to the attainment of which, although subsidized, like every other science, by the sister sciences, IT IS NECESSARY, AND CANNOT BE SUBSTITUTED BY ANY OTHER.

The doctrine of evolution, writes Haeckel, is from now onwards the foundation-stone of the sciences. We shall see if it is also the foundation-stone of the general medical clinic, in the sense that this, through its special initiative, with its special method, can impress on its function proper the character, completely modern and highly scientific, corresponding to the questions and requirements of the theory of evolution.

Comparative anatomy and embryology are gradually discovering by what means and in how many ways, traversing the phenomenon of generation, the variations of the human organism can be effected. Hence the consequence that to the general medical clinic belongs the task of the intimate study of the individualities, such as are derived from the hereditary endowments of the parents, such as gradually express themselves with their particular physiological and pathological attitudes, according to the laws of evolution and adaptation, because the knowledge of the development of the parts destined to fulfil definite functions renders the greater and better knowledge of these less difficult.

Well, the general medical clinic, from the continuous study of anomalies of every kind, has always obtained a profound conviction from which arose that which I can only indicate by the words the *clinical mind*, in virtue of which, from the examination of every function, one conceives a corresponding substratum, so that, by seeing the substratum, one understands the possible function.

I have said *clinical mind* in the same manner that one may speak of a physical, chemical, astronomical, or other mind, wishing to allude to that special determination of the mind which is the necessary consequence of the invariable habit of observing those given phenomena with that given circumspection for reaching definite intentions.

Now, from the history of the sciences we can reveal that the general medical clinic, with the study of the morbid processes, has intuitively perceived the natural phenomenon of individual variation, and has written axioms in connection with it, of which not a few have been the object of polemics for doctrinaire and one-sided scientists. And, unfortunately, by these polemics even the teachers of the clinic have been impressed and much disturbed in their traditional line of conduct.

But the grandiose intuition of the general medical clinic to-day receives the applause of advanced biology. The clinic, it is true, must look back on the past, and correct not a little of what it has done in a period of submission to a guidance not always conformable to the nature of things ; yet, reassured, and more than ever convinced of the truth of its scientific method, and of its function among the biological sciences, it has begun to improve its method of investigation, to concrete better the end of its experiments according to the criteria of the theory of evolution.

Formerly the general medical clinic collected the elements which then constituted the history of the diseases (nosographical pictures) ; later it got to know, and registered, the infinite variety of the morbid forms, and from their examination arrived, as we have said, at the conception of the *individual variation.* Now it feels the necessity of reforming its method of investigation to enable it to contribute to the progress of the science ; and it must in consequence dispose of a method with which it is possible to acquire the most exact idea possible concerning the intimate morphological conditions of the individual, because it must indicate the moment in which the *being* from its primordial development departs from the hereditary type, in order to comprehend better the morphological variation of the individual, his organic resistance, his physiological attributes, and his morbid dispositions. At the bottom of all this it will collect phenomena and facts which will be useful to physiology and anthropology.

To arrange the new clinical method for scientific investigation, it must call upon all its special forces ; it must work, testing and retesting in its environment, with its materials proper, exclusively on man, ignoring the systematic anatomical notion and systematic physiology, because neither averages nor general data have importance for its scope. It is necessary for it to find man what he is in the concrete case, not that which the classical data followed up to now have made us believe him to be.

In this connection I remember a very happy phrase of Baccelli : the clinic must keep to *living anatomy.* To this phrase corresponds the conception of the *individualities* understood according to the science of Lamarck, Darwin, Haeckel, Gegenbaur, etc., through which in this conception is contained the *genetic* notion and the *morphological in evolution*, with the relative physiological attributes.

The zoologist and the clinician equally recognize that for interpreting the facts which result from the comparison of one individual with another the criteria obtained from the forms or from the anatomical relations of the organs are not sufficient, and that one must search for those obtainable by the most exact, *possibly* mathematical, measurements of the dimensions and the distances of the organs.

Consequently the clinic is obliged to find a method of somatometry which can be applied on living man for reaching the knowledge of the *morphological individuality.*

The results obtained by the application of this somatometrical method constitute the structural lines according to which the *individual morphological variation* is formed.

To the living organic fact which results from the somatometrical datum the clinic adds the notion of the physiological function and that of the pathological expressions; and from the innumerable observations and experiments picks out what contributes to the natural history of man.

One can well maintain that the more the science progresses, the more the character and function, eminently scientific, of the general medical clinic reveal themselves. In this connection, Grasset, more by intuition than by a clear conception of the naturalistic clinical method, wisely expresses himself as follows: *La clinique complète le laboratoire et la pathologie est nécessaire à l'édification de la physiologie . . . la maladie réalise vraiment l'expérimentation chez l'homme.*

I can prove that the general medical clinic has already initiated the reform of its scientific method in the sense that I have just mentioned, and has gathered some firstfruits, from which one can draw the most gratifying presage. It will be the fault of the prejudices and doubts mentioned at the beginning of these pages, equally shared by the laity and those versed in the science, if the dark shade, I would almost say of an official conspiracy, should continue to darken the general medical clinic.

Notwithstanding all this, the history of the science will record *that the somatometrical formula for the knowledge of the human individuality has been studied and proposed by the general medical clinic.*

The history of science is also the history of the errors of the human mind, and in the history of the general medical clinic are recorded errors caused by the theories proposed by the auxiliary sciences. And inasmuch as the history of science is not solely the history of errors of the mind, that of the general medical clinic is not to be considered solely a record of errors. There are documents which prove that, when clinical observation has been successful, the scientific conceptions derived from it have been true.

Physiology has said that the circulatory apparatus cannot contain a quantity of blood greater than the capacity of the vessels. This declaration, which is true besides, is enforced, and without the least criticism is enforced likewise in the clinic. From this arose discussions of every kind against the clinical doctrines on *plethora*, besides those on the indications for blood-letting and for many other therapeutic measures. Hence arose also the unjust and strange qualification of the old and vulgar empirical clinic, if one dared discuss it. The principle that the general medical clinic ought to advance on physiological lines having been proclaimed, one plunged, as it were, into a sea of errors.

There is nothing more true than that we must keep to the physiological method ; but we must add that, inasmuch as this method is deduced from observation and experiment regarding the facts and phenomena of the whole zoological series, it *necessarily includes* man.

This reserve, logically and naturalistically maintained, was then considered as an expression of unreasonable attachment to the old, with which euphemism they alluded to the ignorance of him who felt that the very modern affirmations did not contain the whole truth, because in the field of human physio-pathology they are defective in observation and experience.

Meanwhile issued forth, grave and solemn, the doctrine of Lamarck and of Darwin—prepared in Italy by the immortal pages of Marcello Malpighi—in which Hippocratism, many times disowned and scourged by the scholastic polemics and by the darts of its followers, of the pure extollers of the *scientific fashion*—a species of *claque*—Hippocratism purifying and renewing itself, took up the special facts, recognized their naturalistic signification, and returned to the doctrine of plethora. Thus, on the basis of an axiom, at first unknown to physiology itself, it resisted an entire epoch of loud and classic polemics, and put in a more clear light the truth of its special observations.

The axiom is this : During ontogenesis (embryonic development of the living thing) variations of organization are possible, which are greater the more evolved man is in comparison with the lower animals. Works on comparative anatomy, the modern treatises on human anatomy, and important special investigations on the development of the circulatory system, present facts concerning the anomalies of development which are met with in the circulatory apparatus of man—anomalies in number, form, and capacity. All the anomalies regarding excess of development are the morphological basis for the existence of plethora. General, partial, arterial, lymphatic, and venous plethora, and their consequent applications to the genesis of certain diseases and their relative therapeutic indications thus restored, revindicate to the general medical clinic the honour of the initiative in the scientific discovery, and chiefly accredit to it the function in biological studies.

The history of the localization of speech gives undeniable evidence concerning the function of the clinic in biological investigations. The names of Bouillaud, Marc Dax, and Broca indicate the commencement of a luminous era for the contributions of the clinic to the physiology of the brain.

The question of the special secretory nerves of the gastric glands, says Pawlow, is old, and has an interesting history, from which one learns that marked discord existed between physiology and the medical clinic. The latter, on the basis of its own observations, admitted the existence of the secretory nerves of the stomach, and defined their different modes of alteration ; the former was not convinced of it for a long series of years. This, in reality, proves that in the field of the pathological phenomena one must recognize an indefinite series of the most varied combinations, the most extraordinary phenomena, which are to be considered " as an ensemble of physiological experiences realized by nature in living man—a concatenation of phenomena never, perhaps, conceived by any physiologist or pathologist, which cannot be in any way realized with any technics whatsoever." Thus says Pawlow, and he concludes as follows : " The clinical facts will always remain a rich source of physiological teaching, and it is for this that the physiologist desires a closer union with the clinic."

Preyer, the physiologist of Jena, in 1883, speaking of the method of physiology, maintained " that physiological observation must extend itself to the most different living bodies," possessing " the most diverse degrees of development, because what has been verified for one group or for a state of development applies solely to this group or this state. On the other hand, *one must be very guarded in extending directly to man all the results obtained on animals*." And in another place he adds : " Since vivisections are impossible in man, these are substituted by *clinical observation which offers us the best occasion for making* physiological discoveries *on man*."

Therefore, if from one side physiology rehabilitates itself, as Preyer says, by means of a work of comparison, studying organisms in the evolution of the species (phylogenesis), and studying them in the evolution of the individual (ontogenesis), the bonds which connect the general medical clinic with biology will appear more distinct, because it is in the clinic alone that many observations which concern man are possible, and physiology has need of him for closing the series of the natural terms within which it must perform the comparative studies which constitute, so to speak, the substratum of the general biological laws.

Like other sciences for its autonomous part, the general medical clinic has a method, a technic, a process of observation, of experience and of criticism which are incontrovertible. The field of its observations gradually enlarges, as experience indicates ; its experimental activity moves always from the known towards the unknown, following, above all, the biological law. One must not attribute to the clinic the errors of method depending upon false reasoning or upon the predominance of imported theories.

The scientific programme of the general medical clinic is divided into five parts, as follows :

Part I.—Physiological and pathological history of the individual, which includes : (*a*) Examination and criticism of family history and hereditability ; (*b*) verification of the *individual morphological type*, duly noting what concerns the functions of correlation and those of the environment in the fact of adaptation ; (*c*) interpreting on this naturalistic basis the instincts, habits, idiosyncrasies of the individual as possible factors of morbidity ; registering rigorously the onset and progress of the actual disease.

Part II.—Diagnostic study : (*a*) Revealing and registering all the symptoms and all the subjective and objective phenomena regarding not only the part which is the presumed seat of the disease, but also the whole organism ; (*b*) discussing the morbid form according to the guide of clinical experience and the rules of morphology, for recognizing the variety of the clinical form in all its individual and casual accidents ; (*c*) concluding the diagnostic formula with those notes which will constitute the object of special scientific investigations.

Part III.—The diary, in which must be registered all the circumstances which concern : (*a*) The course of the morbid phenomena, spontaneous or determined by the therapeutic experiment ; (*b*) all that which is observed following special investigations conducted for the physio-pathological illustration of the case.

Part IV.—Epilogue of the clinical history, in which figure : (*a*) The contribution of the coincidences of the morphological type with the physiological functions to the scientific discussion of the various arguments ; (*b*) the concluding facts concerning the laws of the organization and of human physiology and pathology ; (*c*) the contribution to the diagnosis and to the therapeutics.

Part V.—When the disease ends in death, the study of the clinic *must finish* with the investigation of the cadaver. In this case the epilogue cannot be made till after the cadaveric inspection. This can only be the free continuation of the clinical study begun during life. Therefore, with a keen eye directed by the clear remembrance of all the phenomena observed during life, besides the ideas conceived, which are not always included in the systematic diagnostic diction, the clinic must direct its special observation on the organs and into the tissues for verifying the possible alterations, not for confirming, as is erroneously said, its special diagnostic value.

He who knows and studies cannot deny that every clinical case presents its singular side, in which resides the reason of the scientific investigation, in consequence the necessity of possible diagnostic doubts or diagnostic intuitions not included, nor possible to be included in the diagnostic formula. All the patrimony of impressions, thoughts, intentions, which the clinic brings to the anatomical table, which cannot be transmitted, which is a scientific property, is also the guide to the speciality of the investigation. Therefore the method of cadaveric investigation must necessarily correspond to that of the clinical study, and the doctrinaire conceptions must be those precisely which have inspired observation on the living body.

The clinic must continue the work, consequently the method of Morgagni : it must be the ocular testimony of the biological events which searches for their reason and consequences ; it must seek the possible arguments for continuing and concluding eventually the discussions begun during life, and must, in fine, complete the study initiated in the concrete case.

He who says that the cadaveric inspection is the touchstone for judging the value of the clinic is not stating a fact. It was owing to the scientific instinct of the clinic that Morgagni has left us his immortal work ; it is owing to clinical illustration that the cadaveric facts acquire their scientific value, and the more the human organism differentiates itself above all the inferior organisms, the more the importance of clinical observation for explaining the cadaveric facts is raised. Besides, it is very natural that while all the sciences are in continuous progress, the general medical clinic cannot have arrived at perfection. This is desirable for humanitarian purposes, to which are dedicated the required and frequently urgent and beneficial provisions of the clinic ; but this is not an argument which applies to the scientific question. Unfortunately, instead, on account of a grave error in the scholastic regulations, and the source of painful doubts, it is the field of sad polemics and vulgar diatribes, in which are indifferently confounded men and things, scientific facts and theories, legitimate aspirations, and unreasonable pretensions, according as they are inspired by incompetency of judgment, spirit of party or of school.

I leave to the workers of the general medical clinic the judgment of the things which I have briefly expounded ; to the wisdom of the legislator the making their due application.

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